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NATIONAL ELECTRIC POWER SUPPLY.

ON Tuesday last, as though by pre-arrangement, but doubtless as the result of pure coincidence, we received a number of documents relating to the reform of electricity supply in this country, which must be regarded as of the first importance to the industry. Particulars will be found elsewhere in this issue of the Memorandum which the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies has addressed to electricity supply undertakers throughout the country, and of the Interim Report of the Committee for the Interconnection of Lancashire and Cheshire Electricity Supply Systems—the first body to take action in the matter; another paper, to which, for want of space, we cannot do justice in this issue, and which is, therefore, deferred for the moment, is the presidential address of Mr. R. A. Chattock to the Birmingham Association of Mechanical Engineers, in which the author discusses the present position of the engineering industry, and advocates the erection—under compulsion by the Government if necessary—of "super-stations" for the generation of electrical energy from coal under the most economical conditions.

These several communications clearly prove that the electricity supply industry is now very wide awake to the defects of the existing system, or, rather, negation of system, on which it is working, and is determined to inaugurate a new era as quickly as possible The activity of the Lancashire and Cheshire Committee merits the highest commendation; with the start gained by its own initiative, and the impetus imparted by the energy of its leaders, it has already shot ahead, and appears to be well on the way to the formation of a provisional Joint Board of Control without awaiting the formal appointment of a Board on the more leisurely lines of a Government Department. The splendid field in which it operates—embracing undertakings capitalised at over eight millions sterling, generating plant rated at 260,918 KW., and an annual output of 421 million units—affords magnificent scope for the adoption of co-operative methods on the largest scale, and the economy foreshadowed as regards the consumption of coal alone, a matter of £82,000 a year at 17s. 6d. per ton, but far greater at present export prices, amply justifies the capital outlay involved, to say nothing of the 30 per cent. increase in effective capacity, and the many other advantages presented by the scheme. A feature of the Committee's report which is of the first importance is the statement that the Treasury will be prepared to

find the money necessary for the scheme of interconnection. We note, too, with satisfaction, that the inclusion of the power companies in the scheme is *regarded as essential*. We trust that in this significant phrase we see the end of the old-time jealousy and distrust with which the municipal authorities viewed the activities and advances of the great companies which, in the face of innumerable obstacles, have laboured to establish their undertakings firmly on what often appeared to be barren soil.

Once more we may draw attention in this connection to the crying need for compulsory wayleaves. Now that the ruling powers have set their minds on the development of connecting links between the different districts, surely they will realise the absolute necessity of providing the facilities required for that purpose, as well as for the ordinary development of any supply undertaking.

Let it not be thought that, because we give pride of place to the speedy Northerners, we do not adequately appraise the value of the important step that has been taken by the Joint Committee. In a sense, the work of the latter covers that of the former, just as the greater includes the less; the Joint Committee, in fact, is calling upon all districts to do that which the Lancashire and Cheshire districts have already done, and is providing the necessary machinery to facilitate the work. The Memorandum which it has issued is admirably conceived, and well backed-up with practical illustrations of some of the advantages of interconnection. Much of what we have said regarding the concrete scheme applies equally to the abstract recommendations of the Joint Committee, and we heartily welcome the evidence of its activity and practical methods of operation. Of the proceedings of the allied Committee—that of the Institution of Electrical Engineers—we have no information as yet, but we have no doubt that it is making progress with its part of the work.

In conclusion, we have one word to say with regard to the Borough of Eccles. It is stated in the Committee's interim report that that borough withheld the information required for the purpose of the investigation. No reason is given for this action, or inaction, but the natural inference is that Eccles wishes to have nothing to do with the scheme. So much the worse for Eccles—but we do not hesitate to say that to oppose a scheme of national economy such as this is to strike a blow for the Germans. At such a time local interests, even if apparently threatened, should not be placed before those of the nation, and we trust that the patriotism of Eccles will yet be manifested by its entry into the scheme.

Industrial Harmony.

However long the war may last it is important that measures be taken in good time to secure industrial harmony after Peace is declared. All the articles and correspondence that have been appearing in the newspaper Press, and all the speeches that have been delivered from public platforms, will avail us little unless they lead to action. The search for a basis for negotiations has occupied many men of eminence in public life during the past few weeks, and we sometimes note with feelings of regret that there is a disposition to ask for practically a new heaven and a new earth in exchange for a truce. We sympathise deeply with the demand of Labour for better conditions, but it will be a pity if the prospects of peace and prosperity are spoiled by arguing for more than industry has it in its power to give. Some of the things that are sought will, we believe, prove to be matters for the legislature and the nation as a whole; others it will be within the power of industry to confer by direct negotiation and agreement with the authorised delegates of the industrial workers. In order that these matters may be exhaustively investigated, affording a basis for a reasonable policy in which the nation, the industries, and the workers shall recognise and carry their own peculiar responsibilities, it is necessary that machinery should exist capable of handling the problems with intelligence, experience, and authority. We therefore extend our hearty good wishes to the new department which Mr. Arthur Henderson, M.P., the Labour Adviser to the Government, has now brought into full operation. We gather from a reference thereto in the *Times* that one of Mr. Henderson's prime objects is to lay the foundations for a regular and definite system of co-operation and communication between industry and the Government. This is most essential if we are to proceed on sure lines, and it is satisfactory to learn that consultative committees of employers and trade unionists have already been appointed, a separate committee being set up to deal with the subject of women's labour. There will also be colonial and international committees which will assist the Department as may be found necessary. One of the great virtues of the foregoing arrangement is that the Department will give all the interests concerned an opportunity for being heard before particular conclusions are arrived at. The industries affected will be able to make their representations from both the employers' and the workmen's standpoints whenever material points are at issue. Mr. Henderson and those associated with him in this very important undertaking are anxious to have the co-operation of all sections of the industry, and the invitation given through the Press to employers and workpeople alike to submit information as to important points of principle to which they desire consideration to be given, will doubtless be accepted. We hope that this is no haphazard or casual invitation. If it is to meet with the response that is necessary it should be brought directly under the attention of at least all the organised bodies that it may concern; probably steps have been taken to that end. Given a proper co-operation on the part of everybody who is eager for the plans of our industrial future to be correctly drawn up, the efforts of the new Department, assuming that its *personnel* is rightly chosen, should have at hand before long just the very material out of which the new basis can be chosen. When such a basis has been decided upon, however, everything will depend upon the spirit in which all parties enter into the deliberations leading up to its general adoption. The spirit of compromise and sweet reasonableness should fully possess all parties, so that we may avoid the abominable waste of dissipating energies which industrial strife would bring if Peace within our borders were broken when Peace between the nations returned. Utopian

dreams of Labour will be as out of place as will the old obdurate spirit of an unbending Capitalism. All things will have to be subject to searching analysis which economic conditions and actual practicalities will inevitably impose, but there will also have to be applied a considerable share of sympathy and regard for fair dealing toward the worker, who will require to give efficient service in exchange for adequate compensation. The difficulties are great, but, given a continuance of the present atmosphere, they should not be overwhelming. Again, we wish success to the new Department, for its work is really the beginning of a national effort toward securing industrial harmony—perhaps by settling the terms upon which a truce for a period of years may be arranged. We are not concerned so much with whether that truce shall be for three or for five years; all that is necessary is for it to be sufficiently lengthy for us to see what the new world conditions during the period of readjustment are going to be and to bring, and what the actual effects of the truce itself will be upon our industries, our workpeople, and our national life, as well as what will be the consequences of those effects upon our relations with our Colonies, our Allies, and the world at large.

Pig Lead.

There has been a deadlock in trading on the Metal Exchange for some weeks past. The slackness of business in the open market, indeed, has been such that the transactions arranged could almost be counted on the fingers of one hand. Official quotations practically throughout have been nominal, and though showing hardly any alteration, there is no mistaking the fact that consumers have experienced considerable difficulty in covering their needs in one direction or another. For one thing, early delivery has been hard to secure, as testified by the comparatively high prices which have been paid privately by consumers, up to about £32. Complaints have been frequently heard of from consumers in that respect, who should bear in mind, however, that the Metal Exchange official quotations cover only shipments in the current and next two months. There can be no free market under present conditions, while the situation is more than ever under the control of the authorities. Operators are, in any case, under restraint inasmuch as persistent efforts are understood to be made to keep down prices. There is probably not much metal coming in that is not earmarked for special requirements, and holders of uncontrolled lead have doubtless no difficulty in finding buyers privately practically on their own terms, regardless of the official prices. This state of affairs is not unlikely to continue until a better supply comes to market. Meanwhile, it is generally recognised that the position is tight, and that any important relief can hardly be brought about unless metal from controlled sources comes out. As to whether this will be realised shortly remains to be seen. There is a confident hope that a change towards easier or more comfortable conditions cannot be delayed much further.

Ordinary manufacturing needs in this country are probably comparatively small, but there is doubtless a constant big outlet in other directions, so that current output is being rapidly absorbed. It had been hoped for some time past that American lead would again come on offer on this side, but there is as yet no sign of this, for the price quoted in New York is still at a figure the equivalent of which represents many pounds a ton over London parity. The market there is apparently under strong control, the Trust showing no indication of undercutting outside producers for the present. The margin there for export is at present small, while the domestic outlet has undoubtedly increased. The output, nevertheless, is heavy, and it is quite on the cards that prices in America will eventually be lowered to a less extravagant level, and possibly result in a renewal of shipments to this country. Spanish lead is coming in in rather limited quantities, due to the continued heavy tonnage sent direct from Spain to France, the total thus dispatched for the first seven months of this year being 38,324 tons, as compared with 17,594 tons in 1915. The total imports by France for that period represented 46,509 tons, against 31,684 tons in the previous year. It is utterly impossible to form an idea of the statistical position in this country so long as returns of the tonnages coming in are incomplete, and chiefly represent metal which is not under control. In the absence of offers in the open market, buyers have lately come to the conclusion that it is almost useless to bid for supplies, which tends to keep prices down.

Hydro-Electric Works in France.

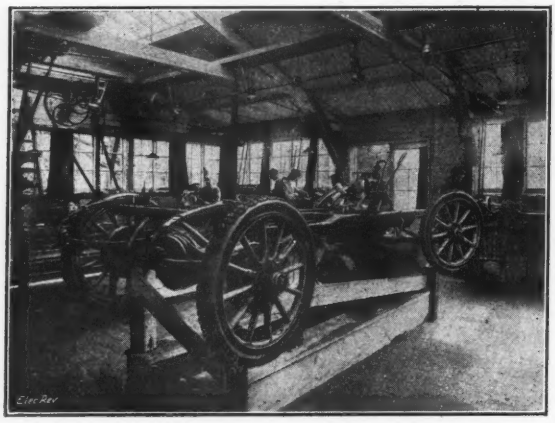
At a time when the prices of coal in France have reached a very high level, special interest attaches to the development of the hydro-electric works in that country, particularly as the consumption of coal annually increases in a greater proportion than the native production. Unless, therefore, a new and extensive coal basin is discovered—which is considered to be improbable—France will always be largely dependent upon supplies of foreign coal, aided by the use of the existing water powers. Fortunately, progress in the latter direction is being made, as is indicated by the information recently published by M. Lévy-Salvador, chief of the technical service of the Department of Agricultural Hydraulics at the Ministry of Agriculture. According to a census taken in regard to the situation at the end of 1915, the power utilised in the French Alps alone amounted to 738,000 H.P., and was divided among the following industries:—

Industries.	Horse-power installed.	Percentage of the total.
Lighting and power	291,000	40
Metallurgy	255,000	34
Electrochemistry	147,000	20
Traction	16,000	2
Saw and paper mills	23,000	2
Various, (chalk, cement, weaving mills, &c.)	6,000	1
Total	738,000	99

The great development which has taken place in the course of years is shown by a comparison of the preceding total H.P. with the state of affairs at the close of 1910, when the H.P. installed only reached 473,000. The number of works has grown in the same period from 126 to 205, those of a capacity exceeding 10,000 H.P. having risen from 13 to 28. Included in the increase is also a number of stations of an individual capacity of less than 500 H.P., these being mostly used for local lighting purposes and in connection with ironworks, textile mills, cement works, and paper mills. Apart from the works already in operation, many important schemes are at present either in course of being carried out or under consideration. The demand for the supply of energy is increasing to such an extent that the distribution companies are quite unable to meet it, and they are preoccupied with the question of drawing upon further water powers to cope with the requirements, whilst at the same time many manufacturers are also seeking locations for the erection of generating plant so as to overcome the difficulties incidental to the high prices of coal.

THE EMPLOYMENT OF DISABLED SAILORS AND SOLDIERS.

We recently described (Elec. Rev., August 4th, 1916) the excellent work that is being done, under the ægis of the Institution of Electrical Engineers, by the Northampton Polytechnic Institute towards the training of disabled fighting men for employment in electricity supply undertakings. We are glad to draw attention in this connection to the admirable arrangements which have been made at Queen Mary's Convalescent Auxiliary Hospitals at Roe-



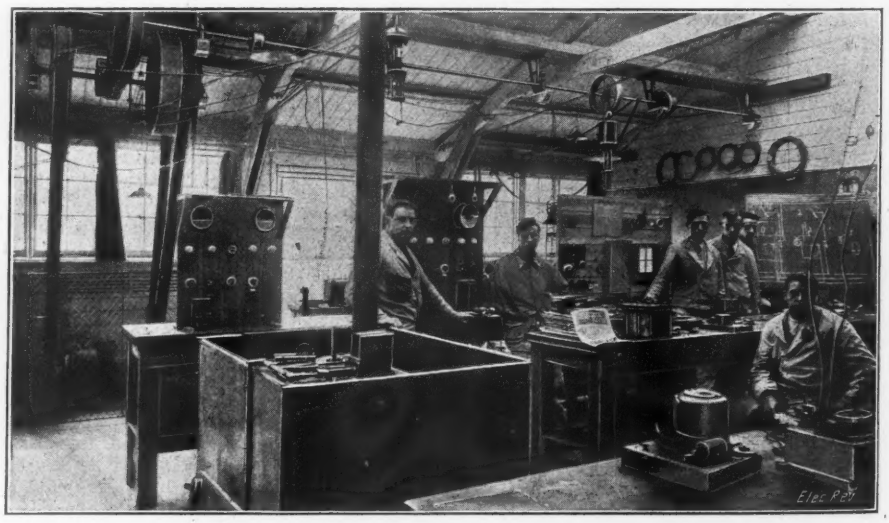
Motor and Lathe Room.

hampton, with similar ends in view. In this case, the men enter the hospital primarily for the purpose of being provided with artificial limbs, and as the process of fitting and testing these appliances occupies two or three weeks, advantage is taken of their presence to impart to them the rudiments of various trades, such as the installation and care of electric lamps, motors, bells, telephones, &c., the management of motor-car mechanism, wood working and cabinet-making, fancy leather work, basket making, and commercial occupations such as book-keeping, shorthand, and typewriting. By the courtesy of Mr. J. M. Andrew, superintendent of the department, we were recently enabled to pay a visit to the workshops, the technical side of which has been organised by Major Robt. Mitchell, Director of Education at the Polytechnic, Regent Street. The cost of the buildings and the original equipment was defrayed by Lady Wantage, and a good deal of additional equipment has been provided by manufacturers, but there is still need of more apparatus, especially in the electrical section. New and saleable apparatus is not essential; there must be hundreds of old and neglected instruments, machines, tools, &c., lying about the premises of manufacturers and contractors, a few of which would be most heartily welcomed by the of the electrical workshops, who would repair them and put them to good use. All kinds of accessories such as small switches (especially two-way tumbler switches) and fuses, used wire and cable, lengths of conduit and fittings, bells and telephones, are acceptable, for reasons which will be obvious later; but the most pressing requirement is a small generating set consisting of an oil engine and dynamo for country-house lighting, up to 5 h.p. We may point out that the loan of such a set for the duration of the war would serve the purpose quite as well as the gift, and we can assure any reader who is willing to assist in this way that he will thus confer a great benefit upon many of those men whom we can never adequately repay for their sacrifice.

The workshops are situated in a range of substantial huts at the rear of the hospital, in pleasant surroundings, and, at present, provide accommodation for about 100 men; extensions are being added as circumstances allow. The men, whose attendance is entirely voluntary, and who select a trade to suit their own inclinations, normally attend from 9.30 to 12.15 daily; they may also spend the afternoon from 1.30 to 3.45 in the shops if they like, and many take advantage of the opportunity. It is interesting to note that electrical work is very popular, some 25 per cent. of the men who attend the workshops going in for it. The work is somewhat interrupted by the requirement that men newly fitted with artificial limbs shall parade for inspection at 11 a.m., but, as this is the main reason for their presence at the hospital, no complaint can be made on this score.

All the shops containing machinery are provided with electric motive power from the electrical shop, which affords opportunities for the care and management of motors to be studied; in the carpenter's shop there are power lathes and saws, and in the motor shop a complete chassis is driven by a small motor, this having been found an excellent method of demonstrating the working of the engine and gearing.

In the electrical workshop a motor supplied with alternating current from the Barnes public mains drives, through belting and countershaft, a direct-current generator, which supplies current for power and lighting to the workshops; this plant is, of course, a valuable item from the educational point of view. The men work in small groups, and receive personal tuition from the instructors. First they spend a few days on bells, indicators, burglar alarms, &c., making all the usual connections; then they connect up three lampholders with single, two-way and intermediate switches, on the bench, and afterwards do this in tubing—which they find a much more difficult task. A three-light fitting with loop-in wires and two switches is the next exercise, after which, on the demonstration boards seen in our illustrations, they connect up six circuits, all different, with two bus-bars, ammeter and voltmeter; the circuits include a circuit-breaker, d.p. switch and fuses, a wall socket, &c., and a pressure of 100 volts is finally applied to the installation, sometimes with interesting, if unexpected, results. The



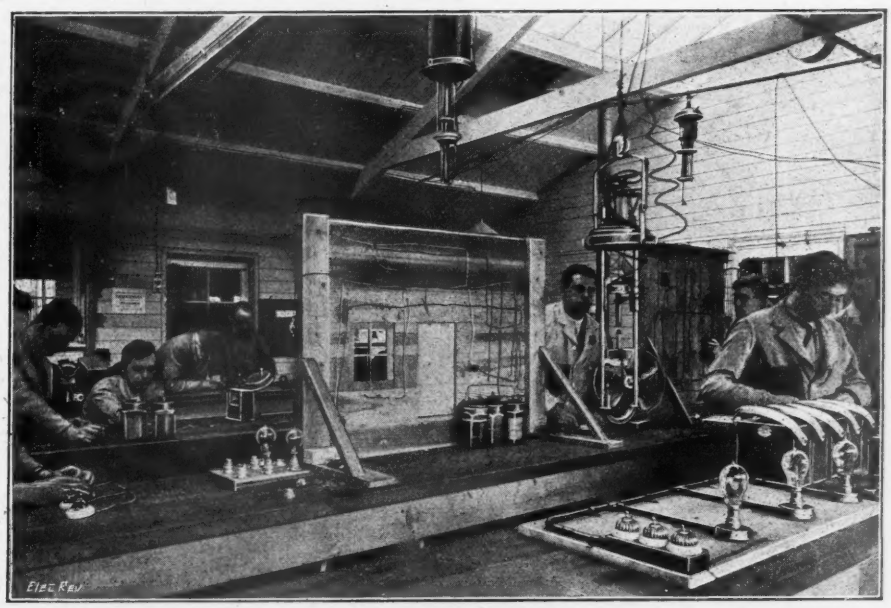
Interior of Electrical Workshop.

circuits wired on the wall in tubing are dismantled and completely re-erected; the main switchboard was fitted up by the men; simple jobs in the lathe and soldering are taught; a small armature is taken apart and rewound; telephone connections are studied—wisely deferred towards the end of the course—and all the usual connections are made for simple circuits. Later on, a set of three interphones will be introduced into the course, and some ideas about alternating currents also will be inculcated. Excellent wiring diagrams have been prepared by the instructors, and we must congratulate them upon the skill and assiduity with which they have devised, and are carrying out, an admirable system of tuition.

Many of the men go on for further instruction to the Regent Street Polytechnic, where they are given free tuition; assistance towards their maintenance is provided from private sources, pending arrangements by the London War Pensions Committee. At the Polytechnic they are instructed in the management of the bioscope, an occupation which is obviously admirably suited to their circumstances.

It is interesting to observe that of the total number of disabled men passing through the hospital, about 50 per cent. are able to return to the posts they occupied before enlisting; 25 per cent. are trained and provided with employment at Roehampton, and the remainder are passed on to the care of local committees in their own districts.

Men partially trained as wiremen are rapidly taken up, and are paid 32s. 6d. a week, plus food. Mr. Isidore Salmon is specially mentioned in this connection, as working hard to place the men, and taking many of them in his own business. Certificates are awarded to those who attend the workshops regularly, stating the number of hours during which they have received instruction. Every effort is made to assist the men to obtain satisfactory employment, and to settle their personal affairs, and the work that is being done by the Hospital appears to us to be worthy of the most cordial commendation and support.



View in Electrical Workshop, showing Demonstration Boards.

NATIONAL ELECTRIC POWER SUPPLY.

Interconnection of Generating Stations.

The Joint Committee's Memorandum.

We have received from the Hon. Secretaries of the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies to consider the question of the linking-up of electricity supply undertakings, a copy of a Memorandum which has been sent to the various town clerks and engineers of municipal supply undertakings, and to the secretaries and engineers of company supply undertakings, together with a letter suggesting that the addressee should attend a general meeting of all the undertakings situated in the group or area in which it is suggested that that particular undertaking should be included, with a view to discussing the Memorandum and appointing a local Committee as indicated therein.

The problems to be considered by the local Committees include:—

1. The consideration of the areas shown on the accompanying map with a view to their better division if considered desirable;

2. The best methods of inter-linking the existing generating stations with a view to their more economical operation, and to the better security of the supply;

3. The best means of providing the capital required for the plant and mains that are necessary, and for the equitable allocation of the same;

4. The best methods of payment between undertakings for any current supplied or interchanged;

5. Any special local arrangements that are considered desirable.

The Memorandum, after referring to the importance to the electric supply industry of the Board of Trade circular letter of May 25th, 1916, and to the forming of the Joint Committee to consider the question of linking-up in all its aspects, states that the importance of linking-up several large stations, and equally of linking-up large stations with small ones, where such linking-up can be carried out without undue capital expenditure, is now becoming more generally realised.

The Joint Committee has arrived at the following conclusions with regard to the suggestion contained in the Board of Trade letter:—

1. That linking-up is important for the purposes of saving fuel, saving labour and increasing the security of supply, and, in the future, making for economy of capital.

2. That the question of linking-up should be considered broadly from the national point of view, and having in mind not only the saving of fuel but the interests of consumers in obtaining a cheap supply of electricity for all purposes.

3. That while the generation of electricity as distinct from its distribution must be considered broadly and irrespective of the present areas of electricity supply undertakings, clearly all existing rights must be respected and existing areas must not be interfered with as regards distribution.

4. That the linking-up of many existing stations could be carried out immediately without further legislation.

5. That in order to arrive at a better understanding of the problem, committees of engineers representative of local electricity supply interests should be appointed in various parts of the country.

To facilitate the formation and work of the local committees the accompanying map has been prepared showing a provisional sub-division of the country into areas, but if local circumstances (known better to engineers) in any area make it desirable to alter the definition of these areas, it is, of course, open to them to suggest any such alteration.

A local committee has already commenced work in the Lancashire area, and the schedule appended shows the information that the committee decided to obtain.

If the local committees will communicate from time to time to the Joint Committee the results of their labours, the experience gained by each local committee can be made available for the use of all, and the Joint Committee is prepared to assist in every possible way.

An Appendix "A" gives two examples showing advantages which in practice have been realised by linking-up, and an Appendix "B" contains a diagram and description illustrating an arrangement likely to be found applicable to many actual cases.

National Electric Supply: Map showing suggested sub-division into Areas. Industrial Areas Shaded.

The Memorandum is signed by the following:—Messrs. J. H. Bowden, W. A. Chamen (Chairman), R. A. Chattock, J. S. Highfield, W. W. Lackie, Charles H. Merz, S. L. Pearce, Thos. Roles, D. A. Starr, W. B. Woodhouse; Hon. Secretaries, H. Faraday Proctor, The Exchange, Bristol; A. de Turckheim, Caxton House, Westminster, S.W.

An explanatory note attached to the Memorandum states that the first public distribution of electricity was carried out by companies working under Provisional Orders granted under the Electric Lighting Acts, 1882 and 1888. Under these Acts their plant and mains are subject to compulsory purchase after 42 years from the date of the Order, and thereafter after recurring periods of 10 years.

The practicability of the business having been proved, many municipal corporations entered the field, supplying in their municipal areas under Provisional Orders, and in other cases they bought up the undertakings of local companies under agreement or arbitration.

Since the year 1900 several companies have been authorised to supply electricity under Special Power Acts, their areas covering the greater part of the industrial districts of the country, and these undertakings are not subject to compulsory purchase.

These three groups provide all the public electric supply in the country, but there are still various tramway undertakings, railway companies, and other industrial concerns providing their own electric supply from independent power stations.

Sufficient time has elapsed, and sufficient experience is available, to show the defects of the original legislation. Experience has shown that the comparatively small areas of the companies and local authorities working under Provisional Orders are, in many cases, insufficient to enable advantage to be taken of modern improvements in plant. It is also evident that the liability to compulsory purchase imposed upon the undertakings of companies working under Provisional Orders has restricted enterprise and retarded the development of electricity supply. Since some of the companies operate in very important districts, immediate measures should be adopted to deal with this difficulty.

One of the most important problems, both at the present time and in the future, is the better utilisation of our coal supplies. An extension of this problem consists in utilising the coal in such a way as to avoid the waste of its valuable constituents and by-products. This object can be attained in a very satisfactory way only by treating the coal at central points on a large scale. Electricity offers by far the most economical and convenient method of distributing the power from these centres.

The following is the schedule of information desired by the Lancashire Local Committee:—(1) Name of authority; (2) area of supply; (3) system of generation and transmission; (4) voltage of generation and transmission; (5) periodicity of system; (6) capacity and type of generating plant installed; (7) total plant capacity in KW. installed, (*a*) A.C., (*b*) C.C.; (8) capacity of boiler plant installed, expressed in KW.; (9) coincident maximum load on system in KW. 1915-16, (*a*) generated, (*b*) purchased; (10) expected coincident maximum load in KW. 1916-17, (*a*) generated, (*b*) purchased; (11) effective generating plant capacity in KW. when plant on order is completed, giving date of latter; (12) facilities for future extensions on existing site; (13) contemplated extensions on new site; (14) maximum Sunday load in KW., (*a*) in winter, (*b*) in summer; (15) total KW.-hours for last completed financial year, (*a*) generated, (*b*) purchased; (16) general remarks.

Appendix "A."—(Actual Results of Linking-up.) I.—Two power stations, each carrying about 7,000 KW. of load, were linked up at a cost of £3,000, the link having a capacity of 3,000 to 4,000 KW.

By shutting down one station each night (12 midnight to 6 a.m.) and week-ends (from noon Saturday to 6 a.m. Monday): (1) The plant load factor at each station has been increased from 67 to 72 per cent; (2) the total saving of coal per annum in both stations has been 2,000 tons, and it is anticipated that this saving will be increased to 3,000 tons.

II.—A power station having a maximum load of 2,000 KW. was linked up with another power station having a maximum load of 15,000 KW.

(1) During the second year of working "linked up," the coal consumption of the smaller station was reduced by 2¼ lb. of coal per unit on all units generated by that station; (2) the combined saving of coal, due to interchange of current, in the second year of working, amounted to 5,500 tons.

In addition to the saving of coal, linking-up has resulted in the following further advantages:—(1) Greater security of supply, (2) reduction in the number of shifts run and wages paid, (3) reduced maintenance charges due to fewer plant hours run, (4) facility for carrying out repairs when stations are shut down, (5) a saving in future capital expenditure owing to reduced amount of stand-by plant and the use of larger generating sets.

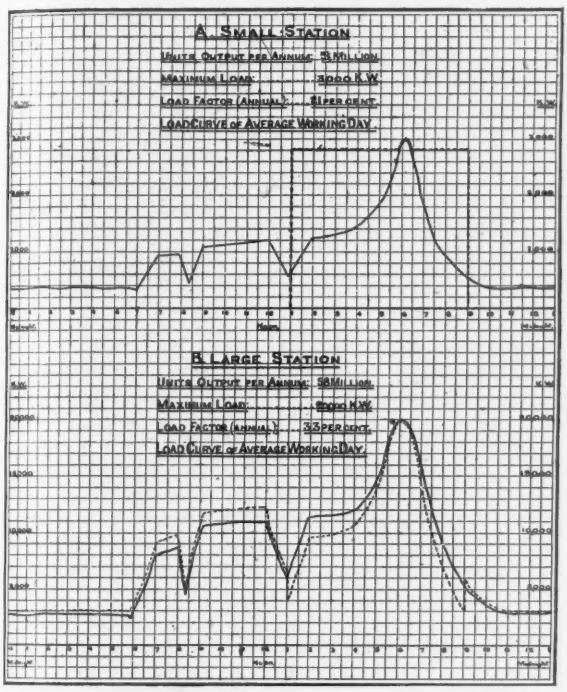
Appendix "B."—(Linking-up Proposal.) A power station (A) having a maximum load of 3,000 KW. links up with another power station (B) having a maximum load of 20,000 KW.

(A) runs for 8 hours (one shift) a day only (and possibly not at all on Sundays), (B) taking the load during the re-

maining 16 hours. During the 8 hours when (A) is running, which would include (A's) peak load, (B) would transfer to (A) sufficient load to keep (A) at a uniform load of 2,800 KW. except at the hours when (A's) own load is 2,800 KW. and over. Such a division of load would result in maintaining (A's) output at 5¼ million units while increasing his plant load factor threefold, (B's) load factor remaining unaltered, while the units delivered from (A) to (B) during the 8 hours when (A) is running would be returned by (B) to (A) during the remaining 16 hours.

Advantages.—(1) Fuel saved; because (A's) load is always sufficient to enable all machines running to be run at most economical load, and (B) gets a better load during the slack hours. A saving of 1 lb. of coal per unit on 5¼ million units is equivalent to 2,500 tons per annum, or, at present prices, say, £1,500 to £3,000, depending upon the locality.

(2) Wages saved; because (A) works one shift instead of three, thereby saving more than half his wages bill and reducing his maintenance charges (because of fewer plant hours).


A. Small Station
Units Output per Annum: 5 Million.
Maximum Load: 2000 K.W.
Load Factor (Annual): 51 per cent.
Load Curve of Average Working Day.
B. Large Station
Units Output per Annum: 5 Million.
Maximum Load: 8000 K.W.
Load Factor (Annual): 33 per cent.
Load Curve of Average Working Day.

It will be seen that such arrangement would not only result in a saving to the nation of 2,500 tons of coal per annum, but a saving to the two electric supply undertakings of, say, £3,000 per annum, including wages, &c., which would give a return of 10 per cent. even if it cost £30,000 to connect up.

Lancashire and Cheshire Scheme.

In connection with the same subject, we have received from Mr. J. A. Robertson, hon. secretary of the Committee for the Interconnection of Lancashire and Cheshire Electricity Supply Systems, a copy of the Interim Report of the Committee, which forms very interesting reading. It is dated September, 1916, and after discussing the question of economy and the needs of the existing situation generally, details the proceedings of the Committee since its inception on May 9th, 1916. Various recommendations are made with a view to co-ordinating the electrical supplies in the districts concerned, and in a number of appendices a mass of data and statistics is set forth. We reproduce on page 400 a map which accompanies the report, showing the generating stations, existing E.H.T. mains, and proposed new mains in the areas included in the scheme. It is interesting to note that the economy anticipated in coal consumption alone, as the result of interconnection of the generating stations, is estimated at £82,000 per annum at 17s. 6d. per ton.

The report, after drawing attention to the necessity for conserving the nation's resources and increasing its producing capacity during and after the war, which has made the subject of electricity supply one of vital and immediate importance, states that it does not profess to deal with questions of general policy, nor does it advocate any comprehensive scheme of centralisation. Its object is rather to indicate the means which can be adopted at once for utilising existing facilities to the fullest extent, so as to meet the present abnormal conditions, and to prepare for the situation which will arise after the war.

Certain conditions arising out of the war have an important bearing on the question :—

(a) The restrictions imposed by the Government on capital expenditure, and the consequent postponement or abandonment of extensions to existing supply undertakings.

(b) The increased price of fuel and other materials, and the scarcity and high price of labour.

(c) The increased adoption of electricity for power purposes, and the necessity for cheapening its production to meet industrial requirements after the war.

To cope with these conditions, the Committee has drawn up a scheme for the interconnection of existing electrical undertakings in certain districts in Lancashire and Cheshire, as a result of which it is believed that the following immediate benefits will be derived :—

(a) The supply from existing stations could be greatly increased, as the generating stations in each district would to a considerable extent act as a reserve or stand-by to each other, thus reducing the amount of reserve plant which has to be kept in readiness in each station in case of emergency. It is estimated that if the generating systems in the areas under review were interconnected the aggregate maximum demand on the whole system could, under normal working conditions, be increased by 30 per cent.

(b) The risk of interruption to supply would be materially diminished in the event of an accident occurring to the plant in one station, as the supply could be maintained from one or more stations in the same district.

(c) By making the fullest use of the efficient plant on each system, and only running the less efficient plant at times of heavy demand, a considerable saving could be effected in fuel, and to a lesser degree in wages, repairs, and other items of expenditure.

(d) A number of the generating stations in each district could be shut down at week-ends, and at times of light load, thus improving the general efficiency of the system, and permitting necessary repairs and overhauling of plant to be carried out with convenience and economy.

(e) The interconnection of electrical undertakings by reducing the amount of stand-by plant would greatly conduce to economy of capital expenditure in future.

The Committee was formed on May 9th, some weeks before the Board of Trade circular on interconnection was issued, held its first meeting on May 16th, 1916, and decided to consider the problem in the first place from its engineering aspect. For the purpose of the scheme the undertakings in the area were divided into six groups, namely :—

GROUP A.

Altrincham Electric Supply Co.; Eccles Corporation; Lancashire and Yorkshire Railway; Middleton, Manchester, and Salford Corporations; Sale and Stretford U.D.C.'s; Stockport Corporation; Trafford Power and Light Supply, Ltd.

GROUP B.

Bolton and Bury Corporations; Heywood U.D.C.; Lancashire Electric Power Co. (Radcliffe); Leigh Corporation; Radcliffe U.D.C.; Rochdale Corporation; South Lancashire Tramways Co. (Atherton); Wigan Corporation.

GROUP C.

Ashton-under-Lyne Corporation; Glossop Supply Co.; Oldham Corporation; Stalybridge, Hyde, &c. (joint board).

GROUP D.

Accrington, Blackburn, Burnley, Colne, Darwen, and Nelson Corporations; Preston Corporation Tramways; Preston Electric Light Co.; Rawtenstall Corporation.

GROUP E.

Birkdale and District Electric Supply Co.; Birkenhead and Bootle Corporations; Hoylake and West Kirby U.D.C.; L. & Y. Railway (Formby); Liverpool Corporation; Liverpool and District Co.; Liverpool Overhead Railway Co.; Mersey Railway Co.; Mersey Power Co. (Runcorn); Ormskirk (Company); Prescot and District Lighting Co.; St. Helens, Southport, Wallasey, and Warrington Corporations.

GROUP F.

Alderley and Wilmslow Electric Supply Co., Ltd.; Crewe and Chester Corporations; Macclesfield Electricity Co., Ltd.; Northwich Electric Supply Co.

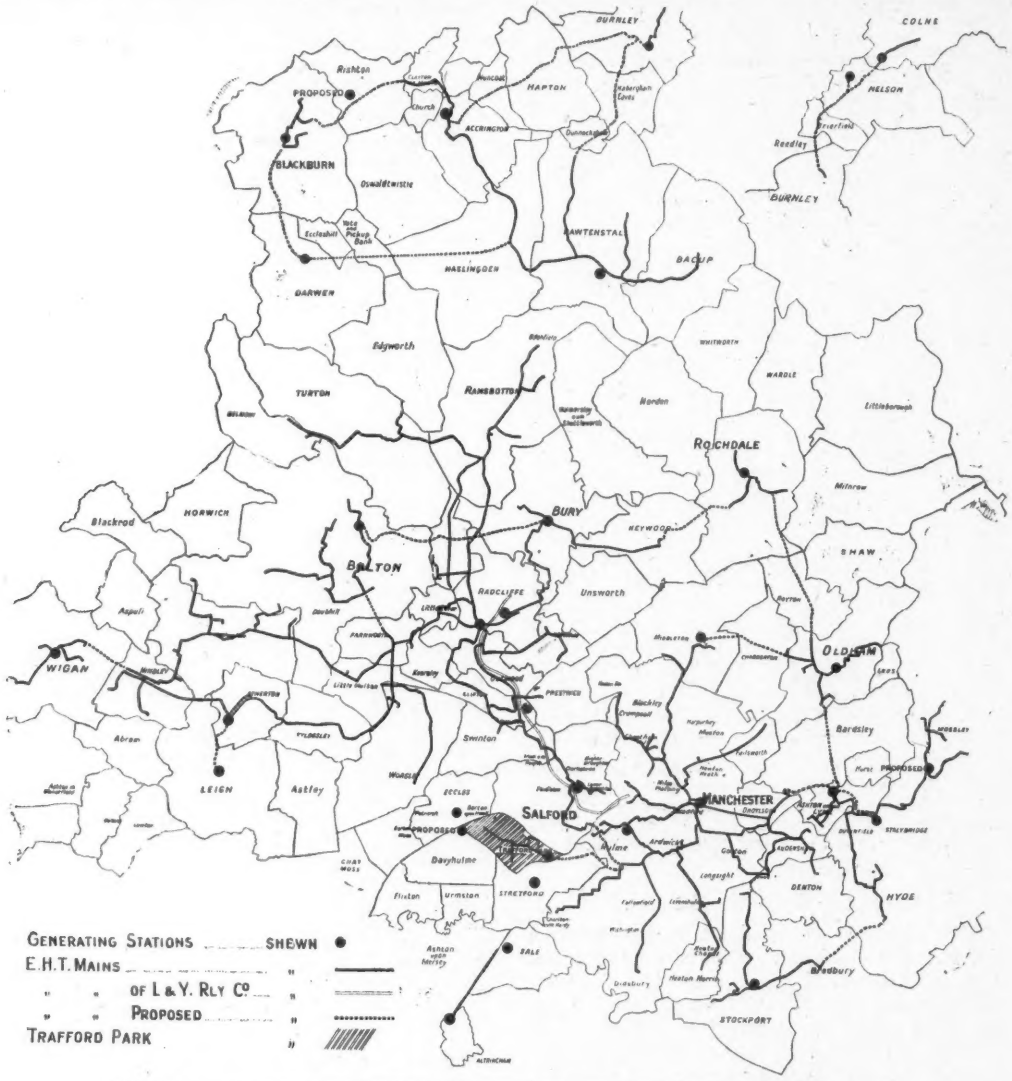
A technical census of these undertakings has been made, and the results are tabulated in an appendix. The map on page 400 shows the position of the generating stations, and the extent to which extra-high-pressure mains have already been laid in the area of supply under consideration.

At an early stage in the proceedings the Committee came to the conclusion that no useful purpose would be served by the inclusion of the five undertakings of Group F, and consequently these have been dropped out of the scheme.

Extra-high-pressure mains have been laid to a much greater extent in the districts included in Groups A, B, and C than in the others, and a scheme for interconnecting the undertakings within these groups could be carried out at a comparatively small cost and with little delay. The majority of the undertakings included in Group D can also be conveniently linked up with each other, but the interconnecting of this group with Groups A, B, and C is not provided for at present. The district within which the undertakings included in Group E are situated is a very wide one, and to interconnect all these undertakings at the present time would entail a capital expenditure out of proportion to the realisable savings. This does not, however, rule out the possibility of adjacent undertakings in this district linking up by mutual agreement.

The Committee, after careful consideration, therefore, has decided for the present to confine its proposals to the four Groups, A, B, C, and D, comprising 32 undertakings. In Group A, the cost of linking up Sale and Altrincham with the other undertakings in the Group could not be justified at present, and this also applies to the two Preston undertakings in Group D. There remain, therefore, 28 undertakings, which include the Lancashire and Yorkshire Railway Co.'s 25-cycle system and the undertaking of the borough of Eccles. The Committee makes no proposals for dealing with these two undertakings in this report, the first named on the ground of expenditure involved, and the last named on account of the necessary information being withheld. Of the remaining 26 undertakings, the majority are operating on the three-phase alternating-current supply system, with 6,600 volts as the pressure of generation and transmission, and 50 periods as the frequency of the system.

Six appendices give information regarding the undertakings



Lancashire and Cheshire Scheme: Map of Area, including Groups A, B, C, and D.

included in Groups A, B, C, and D, under the following heads:—

Capital expenditure and plant capacity.

Units generated and coal consumption.

The estimated capital expenditure involved.

New mains and transformers to be provided for interconnecting purposes.

Principal features of the returns from the undertakings.

Lancashire and Cheshire Electricity Supply Systems—tabulation of technical data.

The estimates in Appendix 3 are based on the abnormal prices now ruling for materials, and, with one or two exceptions, allow a section of not less than 0·15 sq. in. of copper on all new mains, and sufficient capacity of transforming plant to enable any undertaking to receive not less than 3,000 kw. from the adjacent undertakings with which it is connected.

Interconnected stations would enter into arrangements to give, receive or exchange electrical supplies for one or more of the following objects:—

(a) For the purposes of economy only—*i.e.*, to avoid the inefficient running of plant or to facilitate the shutting-down of stations during the week-ends, at night, and at all other times of light loads.

(b) For stand-by purposes, *i.e.*, for emergencies.

(c) For bulk supplies, *i.e.*, in case of a shortage of plant or for economical reasons.

The Committee, after careful consideration, has come to the conclusion that if the undertakings in Groups A, B, C, and D are interconnected, the average coal consumption per unit generated, viz., 3·24 lb., can be reduced by not less than ·5 lb. of coal per unit. With coal at 17s. 6d. per ton, this reduction represents an annual saving on the present output of the undertakings of about £82,000.

Having arrived at these preliminary conclusions, the Committee considered it desirable to ascertain more definitely the views of the Government departments concerned on this question, and after correspondence, a deputation consisting of Mr. Pearce, Mr. Purrett, Mr. Welbourn, Mr. Robertson, Mr. Watson, and Mr. Wheelwright, on July 13th, was received by representatives of the Board of Trade, the Local Government Board, and the Treasury.

The deputation, in the first place, fully explained the steps that had been taken, and advanced the view that, as the whole scheme was part of a national effort to effect economies, and as the return on the outlay involved was so substantial, the Government might favourably consider the question of providing the necessary capital to effect the interconnection proposals on such terms as would prove a strong inducement to the several parties interested to proceed with the scheme. A representative from the Treasury said he was authorised to say that the Treasury would favourably consider the expenditure of moneys required for the scheme, provided that the Local Government Board and the Board of Trade were satisfied with the proposals which might hereafter be submitted to them.

With regard to the coal saving, a representative of the Board of Trade pointed out that, viewed from the national standpoint, the annual saving to the country would be substantially greater than the sum of £82,000 estimated by the Committee, as the present-day export value of coal was 45s. to 50s. per ton.

Considerable discussion ensued with regard to the procedure which would be necessary to give effect to the Committee's proposals.

The deputation considered that powers should be given to a Joint Committee or Joint Board, with a view to co-ordinating the electrical supplies in the various districts on the following lines:—

(a) To raise capital from time to time for the provision of

linking-up mains, transformers, and such other works as may be required for interconnecting purposes, and to allocate all expenditure on the joint scheme on an equitable basis between the undertakings participating in the joint scheme.

(b) To adjust the running hours of the existing generating stations in such a way that the maximum fuel saving might be effected. This would entail the shutting-down of certain stations during the night or week-ends, or at times of light load, the supply being furnished by the stations possessing the more economical plant.

(c) To lay down general rules for determining the charges to be made for :—

1. Reciprocal supplies.
2. Stand-by supplies.
3. Bulk supplies.

(d) To act in an advisory capacity in regard to future extensions of plant ; that is to say, to recommend where such extensions could be carried out to the greatest advantage.

(e) To appoint from time to time such officials as may be necessary to act in an advisory capacity to the Board, and to carry out the instructions of the Board, under powers which may hereafter be conferred by the Government.

The representatives of the Government Departments recognised that some measure of control should be vested in such a Joint Committee if the best results were to be obtained from the scheme.

As a result of its investigation the Committee is satisfied that very substantial economies can be effected by the interconnection of the various electrical undertakings comprised in Groups A, B, C, and D, as indicated above.

(a) In order to bring the scheme before the local authorities and others concerned, the Committee recommends that a conference should be held at an early date of all the statutory supply authorities included in Groups A, B, C, and D. Such conference to be presided over by a Government official.

(b) That, subject to general approval being given to the scheme by the authorities concerned, an application should be made to the Board of Trade to set up a Joint Committee or Board, under Section 8 of the Electric Lighting Act, 1909, with general powers on the lines recommended in the report, and with the addition of further powers, if required, to enable agreements to be entered into with the power companies, whose inclusion in the scheme is regarded as essential.

(c) That pending the appointment of such a Joint Committee or Board, undertakings favourably situated may enter into voluntary arrangements for joint working. Provided that where existing works or works to be laid down for the purpose of interconnecting are suitable and sufficient to form part of the whole co-ordinated scheme at a later date, the capital expenditure on such works, or the annual charges on same, shall be recoverable from the Joint Committee or Board.

(d) In order to ensure that any local scheme for interconnecting shall be carried out in such a way as to conform with the requirements of the scheme as a whole, the Committee recommends that if the proposals contained in this report are adopted, the local authorities interested should temporarily appoint a Joint Committee, to which all proposals for the provision of mains or other interconnecting works shall be submitted for approval or otherwise before such works are commenced.

The report is signed on behalf of the Committee by Mr. S. L. Pearce (chairman) and Mr. J. A. Robertson (hon. secretary).

The estimated expenditure is as follows :—

(1) Estimate of cost to interconnect existing systems in Group A	£58,839
(2) Estimate of cost to interconnect existing systems in Group B	31,375
(3) Estimate of cost to interconnect existing systems in Group C	23,900
(4) Estimate of cost to interconnect Group A with Group B and Group C	83,783
(5) Estimate of cost to interconnect existing systems in Group D	83,500
Total	£281,397

The new mains required average 22,000 yards per group, ranging from 8,800 to 48,400 yards ; with 20,680 yards for interconnecting the groups, the aggregate length is 109,550 yards, or about 62¼ miles. The total capital expenditure and other details regarding the groups are given below :—

Group.	Capital outlay.	Generating plant capacity, kw.	Boiler plant capacity, kw.	Coal consumed per unit gen., lb.
A ...	£4,383,748	131,968	123,680	2·95
B ...	2,112,015	65,636	58,900	3·60
C ...	895,728	33,085	23,530	3·39
D ...	954,097	30,229	22,600	4·0
Total ...	£8,345,588	260,918	228,710	—

The total maximum demand of the 26 undertakings scheduled last winter was 138,429 kw. ; next winter it is expected to be 160,862 kw. The total units generated in the last completed year amounted to over 421 millions, and the average coal consumption of all the stations was 3·24 lb. per unit generated.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Convertible Electric Fires.

The Birmingham Electrical Accessories Manufacturing Co., Ltd., of Whitmore Street, Hockley, Birmingham, has recently introduced a series of low-priced heating devices, amongst which attention may be drawn to the patent convertible electric fire, which can be used either as a decorative fire or as a heater for cooking and kettle boiling. Figs. 1 and 2 show the firm's No. 1

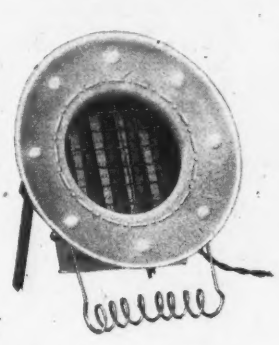


Fig. 1.—Convertible Fire.

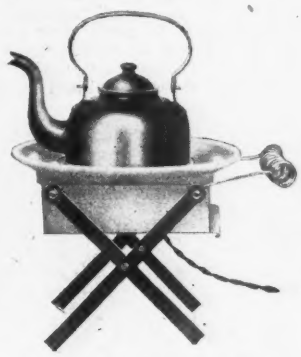


Fig. 2.—Fire used for Water Heating Pattern.

(1,000-watt) pattern in the two positions ; the framework is of vitreous enamelled cast iron, with the heater carried in a steel box and protected in front by a grill.

The firm also supplies a little torpedo radiator for putting under office desks or tables, with a loading of ½ to 1 kw., and the "Smootha" electric iron—a neat little appliance, at a very moderate price. All elements are guaranteed for 12 months, and spare elements are stocked and can be forwarded for the consumer to effect his own replacements.

"Lightning Bug" Electric Lantern.

We understand that Messrs. W. Young, Robinson & Co., of Windsor House, Kingsway, W.C., have placed on the market a new type of electric lantern known as the "Lightning Bug."

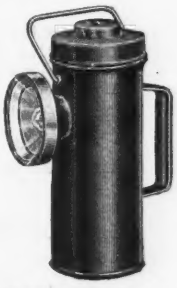


Fig. 3.—"Lightning Bug" Lantern.

A special three-volt battery is supplied with the lantern, which is claimed to give twice the volume of light and to burn three and a-half times as long as a single-cell battery. The lantern will accommodate a standard single-cell battery if desired ; it is fibre-lined, and finished in back enamel, with nickel-plated trimmings.

The Ediswan Esco Buzzer.

A neat and efficient buzzer has been placed on the market by the Edison Swan Electric Co., Ltd., of Ponder's End, and is illus-

Figs. 4 and 5.—"Ediswan" Buzzer.

trated herewith. This buzzer operates with from 2 to 10 dry cells, and is provided with a screw adjustment outside the case, by means of which 12 different tones can be obtained; the adjusting device is shown on the side view. Gold-silver contacts are employed, and the resistance is about two ohms; the finish is black japan, with nickel-plated cover, and the instrument measures $2\frac{1}{8} \times 1\frac{3}{4} \times \frac{5}{8}$ in. over all. The buzzer is useful in substitution for a bell in many situations, and would be suitable for signalling sets, with which many Volunteer signallers provide themselves.

Liquid Starting Gear.

Messrs. Sandycroft, Ltd., of Chester, have extended the variety of their enclosed liquid starting switches to meet additional requirements. A large three-phase starter is provided with worm-gear operation to ensure slow motion; the starting time recommended is from 15 seconds for motors up to 75 h.p. to 30 seconds for motors up to 600 h.p., the motor starting against one and one-half times to twice full-load torque three times per hour. The

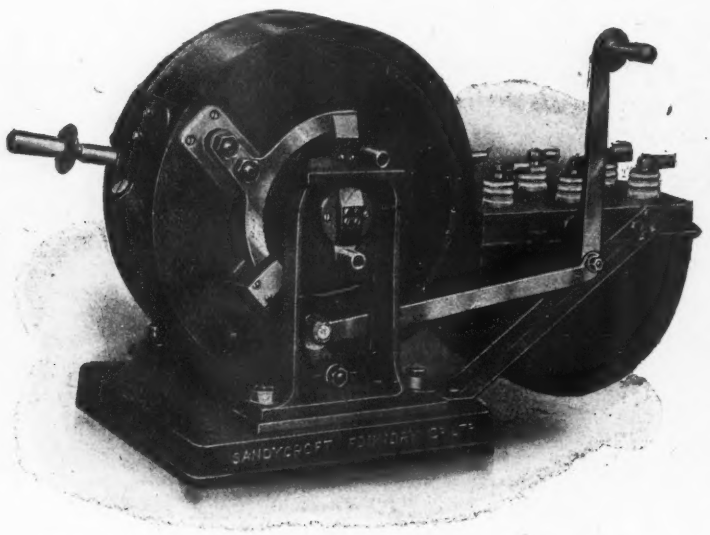


Fig 6.—Three-phase Liquid Starter Interlocked with D.P. Oil-Immersed Stator Reversing Switch.

standard three-phase starter can be combined and interlocked with a D.P. oil-immersed stator reversing switch, as in fig. 6, and a special type having four coupled resistance units on one base-plate, is made for use with the firm's "Cascade" motors. The device is suitable also for haulage motors and automatic control gear for air compressors, &c.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Reform of Electricity Supply.

In the discussion which is proceeding on the proposals for the reform of the electricity supply of Great Britain, the issues, which were originally fairly clear, are becoming involved due to misconception and misunderstanding. Partisanship—that barrier to reform, if tending to grow must be checked. It is very unfortunate that the word *nationalisation* has been mentioned, for in the paper I had the honour to read before the I.E.E. on this subject there is no proposal for the nationalisation of our electricity supply, to which I am opposed.

We are practically unanimous that reform is needed, and the proposals advanced by me were that we should attain that reform by (*a*) co-operation, and (*b*) co-ordination of control.

We must co-operate where centralisation would produce the best results, as, for example, in many instances in the generation and bulk distribution of electricity, but should remain independent where no advantage would accrue from centralisation, viz., in the distribution and application of electricity.

We *already have* Government control of electricity supply in a not very satisfactory form, viz., the Home Office, Local Government Board, Board of Trade, and Parliament itself. There is no co-ordination of control, no live connection between the supply undertakers and the Government, and no scientific plan for the electricity supply of the country as a whole.

The proposal in the paper was to take this existing Government control and vest it in a professional public board, which could watch over the industry as a whole, both in the interests of the public and the legitimate interests of the supply undertakers.

In so far as the powers of this board would be contained in a Parliamentary Bill, it would really be what might be termed a quasi-Government Board, which is very different to a Government Department. The Board would have Government authority through its Bill without many of the restrictions of Government departments. The Port of London Authority is a somewhat similar organisation, and the remarkable success of its administration is its justification. Again, the Public Trustee Office is run on less restricted lines than an ordinary Government department, and is self-supporting, and its success is shown in the rapid rise of this office.

Under this Board enterprise would be extended, and it was to be part of the Board's duties to *encourage private enterprise to the maximum extent.* The Board would operate in conjunction with existing undertakers when this was to the interests of all, and would operate in such districts as were unprovided for, and for which no private or municipal enterprise sought powers.

Shareholders of companies should realise that if reform can be effected in which their interests are protected, and in which their further enterprise is encouraged, then they have everything to gain by it. Those companies in particular whose powers are not in perpetuity would be given a new lease of life under the scheme.

Another point made in the paper was that drastic alterations and the immediate sweeping away of existing generating stations were not proposed. The proposed Board would lay out plans for the supply of this country to meet its requirements, say, 15 years hence, and then see that all new plant, new stations, new interconnecting mains, &c., &c., were devised to form part of the final scheme. The necessity for, and value of, a transition period was insisted on, both for economic and administrative reasons.

To sum up—reform by co-operation and co-ordination was to take place on the basis of protecting and advancing the interests of existing undertakings and those who had invested their money in them, whether shareholders or corporations. It is possible to do this and at the same time benefit the country as a whole, because the electricity supply industry is rapidly growing. The saving in coal alone under the scheme would amount to several millions sterling per annum. The owners of the undertakings, as well as the general public, would participate in this beneficial result.

Moreover, it must not be lost sight of that if the supply industry is not reformed from within it will be taken that the industry is not capable of effecting such much-needed reform. This leaves it open to attack from without, when probably more drastic and less equitable action would result. Apart from this, it is the duty of all to look at the problem from the standpoint of the national need, and seek to attain the desired end.

It is useless to expect to achieve this result by taking a short and narrow view. Any particular series of proposals if looked at from the standpoint of the immediate results might not be considered advantageous, but studied with a view to the ultimate result, for which all undertakings would be working on a preconceived and scientific plan, would certainly be carried out. In this connection, the establishment of the Public Electricity Board would inspire confidence and justify the broader view being accepted by individual undertakings.

There is no reason to fear that because powers are vested in a public board sympathetic to electricity supply, personal interests will suffer—we may reasonably expect the opposite. So long as these interests are adequately protected in the Bill, and we can be assured those responsible will see to this, then the shareholders should work for the reform as being in *their* interests and the interests of the whole country.

Finally, let us not make the foolish mistake of distrusting those who represent the industry in positions of influence. The recommendation (2) of the Council of the I.E.E. to the Board of Trade means, I take it, neither more nor less than it states, and the Council of the I.E.E. deserves the thanks and encouragement of the industry for all the trouble it has taken in this matter.

When we read the names of those who constitute the committees dealing with this reform in electricity supply we can be assured, by their past and present achievements, that they will only take such steps as they are satisfied will be steps of true progress, which includes the interests of the industry itself as well as those of the greater public.

I hope the time may not be far distant when the Council, with the support of the whole industry and shareholders, may be able to boldly approach the Government and ask for the Parliamentary authorisation of a complete scheme somewhat as outlined in the paper discussed by the Institution.

Ernest T. Williams.

London, N.W., *October 3rd*, 1916.

Precedence for Disabled Men.

I must apologise for the delay in tendering my thanks for the Electrical Review, which continues to arrive regularly. Owing to the fact that we have been engaged in the recent "strafe" here, postal arrangements have been somewhat upset, and the arrival of six copies at one time meant some concentration to get into touch again with current events. I need hardly say—since others in like case have already expressed their views—that your valuable paper is the great barrier between us and "rust" in matters electrical.

Those of us who were serving with the Territorial Force, other than in a specialist unit, at the outbreak of war have perhaps had occasion to regret the difficulties of getting transferred to a unit where we could use our technical knowledge in the interests of the country. We hope the time is past when technically-trained men will be debarred from leaving a "fighting" unit for a "specialist" unit.

Surely it is as essential to "run" the human element on as efficient lines as the mechanical?

It is gratifying to read the accounts in your columns of what is being done in training disabled soldiers and sailors for power-house and sub-station duties, &c. All honour to those who are willing to do so much for those who have given so much, and it is to be hoped that the disabled members of the Services who are now filling the gaps in electrical staffs may be able to continue to do so permanently.

In your issue of August 18th Mr. Killingworth Hedges, writing on this subject, raises a point, along with that of pensions, which to my mind is of as much importance as the pension question. I quote the passage: "As the disabled men will probably in some cases lose their jobs when the large number of mechanics now in the Army return to work."

It must be painfully obvious to most thinking people that the struggle we are now engaged in will not cease with "cease fire." We shall have as great a duty after as now, and we must have as fit armies industrially then as military now.

In four years' experience as attendance in sub-station and power house, I formed the conclusion that they are not the places to bring out the best in a man who wants to go further—rather, there is a tendency to "rest on one's oars" and be content to see that the kilowatts are delivered to those who are keeping the great industrial machine going. At the same time, this class of job is capable of providing a very fair living for a disabled man (or pair may be the latest pathetic combination), whether or no he (or they) is overburdened with his disablement pension.

Can there be no guarantee given to such men as prove suitable to be able to continue in the billet they have been fitted for, many of whom will perhaps have insufficient technical knowledge or practical experience outside what they have specialised in, to enable them to compete in other directions?

Such of us as return from this "strafe" physically sound should make it a point of honour to keep out of such jobs as our less fortunate comrades can fill, but who are, on account of their honourable disabilities, debarred from greater efforts.

As we are comrades in arms now, so let that *camaraderie* continue, and let the fittest be in the "first line" as a common duty in the struggle to come.

Perhaps station engineers and others in choosing their staffs later on will see the justice of giving preference to the disabled.

We have been told as "Tommies," "Your sufferings and privations will not be forgotten by a grateful country," but we sometimes argue whether there will be time for sentiment later on. Let us give the unfit a chance first.

Maybe there is sufficient point in this argument to induce you to give publicity to a question liable to be overlooked, but which is a very real question to many men who have been through the war-mill and emerged "unfit for active service." Thanking you for your interest,

A. P. Holloway (Sergt.).

Egyptian Expeditionary Force.

[Those who are "willing to do so much" for our wounded heroes know well that they can *never do enough for them;* how can a man be adequately compensated for the sacrifice of a limb, or—worst of all—of sight? When all is done, we shall remain their debtors, and we heartily endorse Sergeant Holloway's appeal to station managers to give preference to the disabled, and to their comrades to make way for them.—Eds. Elec. Rev.]

Closing Down the Electrical Co., Ltd.

Referring to the note headed "Closing Down the Electrical Co., Ltd.," and signed "Contractor," appearing in your last issue, your anonymous correspondent is disturbing himself, and those of your readers who pay any attention to his views, quite unnecessarily. I am in a position to assure you that the Board of Trade, to whom all controllers are accountable, exercises the greatest possible care to see that any sale of a business as a going concern under the powers of the Trading with the Enemy Amendment Act, is a genuine sale to *bona-fide* new owners of British origin, and there is no possible "loophole for the present owners to purchase the business and keep it going until such time as the war is ended," as your correspondent suggests.

I should not have thought it worth while to refer to the matter had it not been for the criticisms that have been appearing in other journals recently regarding the Board of Trade's handling of the Trading with the Enemy Amendment Act, and I am, therefore, glad to take this opportunity of stating that in my opinion the Act is being administered by that Department in a most efficient and practical manner, and without any avoidable delays.

Maurice Jenks,
Controller to the Electrical Co., Ltd., and other German-owned businesses.

London, E.C., *October 9th*, 1916.

Ozone in Military Surgery.

I notice in the current number of the Review a note on "Ozone in Military Surgery," in which you speak of "a novel method of treatment." Surely you remember Dr. Stoker, of the Oxygen Hospital. Doctor, now Major, Stoker, R.A.M.C., is the one responsible for this treatment, but you create quite an erroneous impression by speaking of it as "a novel treatment." Major Stoker has been practising it and advocating it for years, and for more years than that it has been in regular use on the Continent. It is quite true that it is only recently that it has been possible to use it on such an extensive scale, but probably if there were a little more enlightenment on these subjects, and a little less official opposition, it would not take 12 or 15 years to introduce such a wonderful treatment, and at the end of the 12 or 15 years to have it brought under one's notice as "a novel method of treatment."

Ozonair, Ltd.
Edward A. Joseph, *Director & General Manager.*

[We recollect nothing of the Oxygen Hospital, but we feel certain that the use of ozone as described in our note is a real innovation in military surgery. Can Mr. Joseph show that the treatment has ever before been applied to wounds received in warfare?

If the process itself is old, and yet unknown, "surely" that is Mr. Joseph's fault; various articles on the uses of ozone have appeared in our pages, but this particular treatment has never been brought to our notice.—Eds. Elec. Rev.]

Domestic Electric Openings in India.

I shall be glad if you will kindly publish the following in your paper, for the purpose of showing the various electrical firms the domestic requirements in the Indian Bazaars:—There appears to be great demand for small domestic grinding mills suitable for grinding wheat, grain, and maize, for domestic purposes, driven by small electric motors of 220 volts D.C. The machine should be capable of adjustment for grinding coarse or fine flour of the various kinds. It should also be capable of grinding not more than 10 lb. an hour. Anything larger than this would not be a saleable article. The machine is intended for purely domestic use for grinding the household requirements, as the Indian, owing to his caste, prefers to have the wheat ground on his own premises.

Particulars are solicited from various electrical firms, and should be addressed to

H. C. Greenwood,
Chief Electrical Engineer.

Municipal Committee, Amritsar, *September 15th*, 1916.

WAR ITEMS.

Another Committee to be Appointed.—According to Mr. Percy Alden, M.P., the Government is appointing a Social and Economic Committee.

Wages in Railway Shops.—It has been agreed that all men employed in the railway workshops shall receive a war bonus of 5s. a week, and all boys (under 18) similarly employed 2s. 6d. a week.

Tramways and Munitions.—The Ministry of Munitions has intimated to the South Shields Corporation that the Corporation tramway undertaking is a certified trade, as it is of importance in connection with the carrying on of munition work.

Trading With the Enemy: Black List.—The Foreign Trade Department has issued a new consolidating list, containing the names of over 2,000 persons and firms with whom persons in the United Kingdom are forbidden to trade under the Trading with the Enemy (Statutory List) Proclamation, 1916. Although the list has now been in existence for seven months, cases still come to the notice of the department in which firms are corresponding with persons whose names appear in it. It is important, the department points out, that everyone engaged in foreign trade should realise that he is under obligation to make himself familiar with the statutory list, and to observe it in his dealings. Failure in this respect renders him liable to heavy penalties.—*Daily Telegraph.*

Waste.—The Lord Mayor of Birmingham says that the war has taught us that there was tremendous waste in business through insane competition—competition between capital and capital, labour and labour, and capital and labour. All must work in harmony.—*Times.*

A Swiss Trade Forecast.—The U.S. Consul at Berne quotes the following views expressed by a leading Swiss firm respecting the present and future economic conditions in Europe:—"We presume that the war will introduce great changes in American trade relations, and that many European agencies now lodged solely in the hands of German firms will be better transferred to neutral ground. On the other hand, a great many articles, which America in the past was unable to send to Europe in successful competition with European products, will come to the front in view of America's greater financial supremacy and the dissipation in all the belligerent countries of all competitive power."

Electrical Trade After the War.—The Woolwich B.C. has received a letter from the Council of the I.M.E.A. stating that it has appointed representatives to give evidence before the Electrical Trades Committee appointed by the Board of Trade to consider the question of British trade after the war. It is proposed to draw the attention of the Committee to several matters of special importance in the trading interests of municipal undertakings, and to emphasise the fact that such undertakings are especially concerned in the development of British trade after the war. In many towns, continues the letter, large capital outlay has been incurred in order to meet the demand for power required for the manufacture of munitions, and unless, after the war, there is a great development of British trade to absorb the power so provided, there will be a large amount of capital not bringing in adequate return. Such being the case, it is desirable that the representatives of the I.M.E.A. should be able to give the Board of Trade Committee some idea of the amount of capital which has been expended for war purposes, and the Association asks the B.C. to let it have approximate figures for such expenditure in connection with the Woolwich undertaking under the usual headings of land, buildings, machinery, mains, &c., the figures to include all work in hand or about to be put into execution, as well as that already carried out. The B.C. has authorised the electrical engineer to furnish the Association with the desired information, and to bring to its notice the importance of maintaining for general manufacturing purposes the various munition factories established in the country during the war.

The Financial Results of Continental Companies in Wartime.—The accompanying table represents a list of a number of the investments held by the Bank for Electrical Undertakings, of Zurich, and shows the financial results of each, as far as ascertainable, for the past three years. The figures given are percentages on the ordinary shares:—

Dividend Percentage on Ordinary Shares.

	1913 or 1913-14.	1914 or 1914-15.	1915 or 1915-16.
Officine Elettriche Genovesi, Genoa	10	10	6
Società Meridionale, Naples	4	5.2	5.2
Dinamo, Milan	3	4	4
Idroelettrica Ligure, Milan	8	8	8
Società Adriatica, Venice	7	7	7
Soc. Elett. Riviera di Ponente (R. Negri), Milan	6	6	6
Soc. Idroelettrica Valle d'Aosta, Milan	—	—	5
Compania Sevillana, Sevilla	8	8	7
Gaz et Electricité, Lisbon	7½	3¾	—
Strassburg Electricity Works	11	11	11
Rheinfelden Power Works	8	8	8
German Transmarine Electricity	11	10	10
Abo Electricity Works, Finland	7	—	—
Silesian Gas and Electricity, Breslau	10	10	10
Mark Electricity Works, Berlin	5½	3½	3
Upper Rhenish Power Works, Mulhausen	6	—	—
Konigsburg (Prussia) Electricity and Tramways	8	8	—
Main Power Works, Hochst	5	5	5
Lech Electricity Works, Augsburg	7½	—	—
Thuringia Electricity Supply, Gotha	4½	4½	5
Lower Elbe Electricity Works, Altona	4	5	5
Electricity Supply Co., Berlin	12	10	10
Bavarian Supply Co., Bayreuth	—	4	—
Petrograd (1886) Lighting Co., Petrograd	8	8	7
Electrica, Bucharest	9	9	9
Compagnie Centrale d'Energie, Paris	5	—	—
Central Swiss Power Works, Lucerne	5	5	6
Unione Italiana Tramways, Genoa	9½	8½	7
Berlin Elevated and Underground Railway	6	4½	4
Silesian Light Railway, Kattowitz	2½	2½	2½
Bitterfeld Electrochemical Works	10	10	10
Brandenburg Carbide and Electricity, Berlin	—	7	—
Bavarian Nitrogen, Munich	8	—	—
Brown, Boveri & Co., Baden	5	5	6
Felten & Guilleaume, Mulheim	8	8	11
Motor Applied Electricity, Baden	7	7	7
Watt Electrical Undertakings, Glarus	6½	5½	3
Societé Centrale, Paris	6	—	—
Soc. Impresa Elettriche, Milan	7	7	7
Berlin Electrical Industry Bank	4	4	—
Electro-Trustee Bank, Hamburg	5½	5½	5½
Electricity Co. (late Lahmeyer), Frankfort-on-Main	7	6	7

It should be mentioned that in a few cases where no percentages are given for last year the financial results have not yet been published.

Exemption Applications.—At the Shoreditch Tribunal, Mr. L. Davis (trading as the Reliance Wire Co.), of Curtain Road, E.C., appealed for G. W. Hardy (37), mechanical fitter. The firm were stated to be doing a large amount of electrical work for contractors who were working for the Ministry of Munitions. The work was of such a nature that they believed they were entitled to a badge, and had applied to the Ministry of Munitions for one. They had been told that the matter was under consideration, and were advised to appeal meanwhile. They had a turnover of £17,000 a year, and had 100 machines running by power, which were looked after by Hardy. Mr. Weber said it was rather obvious the Ministry of Munitions had decided that it was a case for the Tribunal to settle, and not them. The Tribunal decided to grant four months' conditional on joining the V.T.C.

At Boston, Mr. R. W. Sanders, electrical engineer, applied for the retention of C. E. Clare (30), electrical case-maker, on the ground that he was indispensable. Mr. Sanders stated that the man was the only one he had on this class of work, and he was voluntarily badged. Major Bell replied that this class of badge had "run out." Clare said that he was the only man in the town who could do this class of work. The appeal was refused.

At Oxford, conditional exemption was sought by Mr. H. G. Watson (28), electrical engineer and fitter, sole owner and manager of an electrical business. He stated that all his capital was invested in the concern, that he had large lighting contracts, had lost the whole of his staff, and now had to carry on the business single-handed. The Military Representative suggested that, having lost all his staff, appellant should go into the Army, where he would be very useful, but it was pointed out that the business was an old-established one, that he had contracts with eight colleges, and that his last man was joining up on October 11th. Conditional exemption was allowed on appellant remaining in the O.V.R.

Application was made by Mr. F. G. Curel, engineer and manager of the electric light department of the Witney U.D.C., for extended exemption for Victor Brice (19), electrician. Mr. Curel stated that it was quite impossible to replace Brice. He had advertised three times, but had received no replies. He had been passed for garrison duty at home. The Tribunal allowed two months in which to obtain a substitute.

Mr. Trivett, electrical engineer, Seaton (Devon), appealed for Herman Cawley, and he was given until November 30th to get a substitute.

At Reigate, Mr. Makovski, of Messrs. Tamplin & Makovski, electrical engineers, appealed for W. H. W. Peachey (19), passed for home garrison duty. The Military Representative said they were anxious to get hold of home service men to release others. The appeal was dismissed, the calling-up to be delayed until October 25th.

At Chelmsford, Messrs. Christy Bros. & Co., Ltd., appealed for A. Urquhart (33) and Frank Hart (36), highly-skilled erectors of electrical machinery. With assent, the appeals were allowed.

Before the West Kent Appeal Court, exemption was claimed for C. E. Stow, electrician to Mr. J. Russell, at Halstead Place, near Sevenoaks. Appellant said that he suffered from a dilated heart, and was only fit to do light work. The Military Representative intimated that there would be another medical examination when applicant was called up, and if he was a clever electrician he would probably be put in a part of the Army where he would be useful. The appeal was rejected.

At Maidstone, Mr. Lambert, manager of the Corporation tramways, appealed to the West Kent Tribunal for the chief clerk, Mr. F. Bryan (27), and asked for time in which to train a woman to do the work. The Court refused any exemption.

At Holyhead, the municipal electrical engineer (Mr. P. Williams) appealed for a fireman, previously exempted until September 25th. He stated that all efforts to replace the man had failed, and, in the interests of the community, it was essential that someone should do the work. The Tribunal conceded two months.

On appeal to the Epsom Rural Tribunal, Mr. G. Williams, electrical engineer, of Downside Mill, Cobham, has obtained three months' exemption.

At Southend-on-Sea, Messrs. H. Garon, Ltd., High Street, appealed for an electrician, aged 25, and he was granted until the New Year.

At the Middlesbrough Tribunal, a firm of electrical engineers applied for exemption for the manager of the electrical department, who had been passed for service abroad, but not for general service. The employer said that if exemption were given the man, a badge could be obtained for him. Exemption until January 1st.

At the Winchester Tribunal, the Mayor and Ald. Stopher did not adjudicate in an application by the Corporation electricity department for the exemption of a shift engineer in the power station, aged 19. The engineer said that this was a certified occupation, and although he had been willing to release the man, who was in Group 1, if he could obtain a qualified substitute, he had been unable to do so. He had applied to the barracks to see if he could get a disabled soldier, but without result. He asked for exemption until he could get a skilled substitute. The Tribunal found that the man was engaged in a reserved occupation, but intimated that they would be pleased if a substitute could be found.

At Ilfracombe, the Electric Light Co. applied for the retention of Mr. H. J. Stewart, resident engineer and manager, certified occupation being claimed. On the same ground, exemption was sought for Alfred James Rudd, stoker. Each was granted conditional exemption.

At Bath, Messrs. R. Kendall & Sons applied for the re-

moval of a condition for exemption that an electric fitter named A. C. Brackstone (39), should obtain munition work within 14 days, on the ground that another of their employés had been taken for munition work. General Bradshaw intimated that if the man was in the C Class he would probably not oppose the application. For this purpose a medical examination was ordered.

At Ryde (I.O.W.), a letter was read from Mr. A. F. Braithwaite (39), electric power station engineer and local manager of the Ryde electric supply system, stating that in consequence of a serious illness, including an operation, he was not sufficiently strong to undertake military duties. A medical certificate enclosed stated that he was totally unfit for military service, and conditional exemption was granted.

Mr. A. L. Duncan, of Knossington Grange, appealed to the Melton Mowbray Tribunal for Edwin Stableford, his electrical engineer. Final exemption until January 1st was conceded.

At Maidstone, Messrs. Oswald Jones & Co., electrical engineers, appealed for Mr. E. W. Sells (33), their business manager. Mr. Jones stated, that Mr. Sells was originally rejected, but had now been passed for general service. They had lost 12 out of 16 men. Exemption was refused.

At Barking, Mr. W. E. Kidnor, acting electrical engineer to the U.D.C., appealed for J. J. White, motor-man. He said that the Ministry of Munitions was not issuing badges, but intimated that men who were exclusively engaged in tramway work were in a certified occupation, and that appeal must be made to the local tribunal. Two months were allowed, with leave to appeal.

At Brighton, an electrical engineer who appealed stated that he had charge of four electric lifts, and of a firm's electrical appliances to enable all the hands to make munitions. Asked if a month's exemption would meet the case, appellant replied in the negative. Conditional exemption was given on appellant joining the Volunteers.

Before the Gloucestershire Appeal Court, the Bourton-on-the-Water Electric Light & Power Co., Ltd., appealed for the retention of an employé, aged 19, having the entire charge of the plant, and who could not be replaced, as a substitute could not be found. The Chairman expressed the opinion that a substitute could be found if the company offered higher wages. The appeal was dismissed, and the calling-up delayed for a month.

Maidenhead Tribunal has given exemption until January 1st, on his joining the V.T.C., to George P. Lovegrove (33), electric fitter with Mr. Jonathan Bond.

Before the Herts. Appeal Court, the North Metropolitan Electric Co. claimed exemption for Thomas George Brookwell (20), junior charge-engineer, claimed to be in a certified occupation. It transpired that Brookwell was only engaged on approval last July, and the Chairman observed that the company would have to put up a very strong case. The representative of the company said that the man was passed for sedentary work at home only. Mr. E. J. Gape (military representative): In that case, I don't want him. If you had taken the certificate before the City Tribunal you would have had exactly the same treatment. The appeal was dismissed, with right to appeal when Brookwell is called up.

At Shipley, an arc lamp trimmer, employed by the District Council, applied for exemption. He was given until November 1st, but was told to get work of national importance in the meantime.

BUSINESS NOTES.

Japanese Porcelain.—The U.S. Consul at Yokohama says that a considerable increase in the demand for Japanese porcelain, as a substitute for European products, in the United States, Canada, Australia, India and the South Seas is reported by the *Japan Chronicle*. Before the war, the yearly exports amounted to about $1,994,000 in value, but this year more than $2,492,500 worth has already been exported in the first six months. "In Owari, Mino, Kyoto, Kyushu and other porcelain-producing centres in Japan, manufacturers are almost suspending the manufacture of goods for domestic use, and are throwing their energies into articles for export. According to merchants here, Japanese porcelain goods, especially insulators and other articles for industrial purposes, shipped to India, Australia, and the South Seas compare quite favourably both in price and quality with European products, but table utensils exported to the United States, Canada and other places are inferior to German goods in many respects, and it is expected that the Japanese articles will find it difficult to maintain a place on the markets opened to them by the war."

Trade Combinations in Russia.—The U.S. Commercial Attaché at Petrograd in reporting, states that there has been legislation in Russia against combinations in restraint of trade, similar to anti-trust legislation in the United States. For instance, in Russia it is not possible for one company to hold stock of another company. The Russian Government, however, has not restricted the formation of community-of-interest organisations, which are not incorporated companies, but are associations of individuals with common meeting places. The Government does not interfere with the holding of such meetings, and requires no official scrutiny of the records. At the meetings of such societies prospective orders from the Government and from private railways and other interests are discussed, and schedules are drawn up showing the capacities of the various works. Prospective orders are then apportioned to suit conditions, at prices common to all. In consideration of this apportionment of orders, the fitness of certain works to manufacture special classes of articles, such as cars or locomotives, or to furnish certain sections of rails, or structural material, or certain qualities of steel, is given careful attention at the meetings. Prominent among the community-of-interest organisations are the Prodamet, a combination of more than 30 big steel concerns; the Prodoparovoz, a combination of seven locomotive makers; and the Prodovagon, a combination of 12 car builders. The central committees of these organisations act as both selling and purchasing agents. They are opposed to purchasing in foreign countries any goods that can be produced in Russia. There is no record that any member of these organisations has contravened the letter or the spirit of the agreements.

Book Notices.—The *Faraday House Journal* for the Michaelmas term contains the first of a series of "Notes on Electrical Engineering," by Dr. Alexander Russell; a biographical sketch of J. K. Stothert; and obituary notices of Second-Lieuts. F. R. Hoggett and J. H. Parr-Dudley, as well as additions to the lengthy Roll of Honour of Faraday House.

"*Journal* of the Manchester Municipal School of Technology." Vol. VIII. Manchester: The Education Committee.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXV. No. 9. September, 1916. New York: The Institute. Price $1.

"Scientific Papers of the Bureau of Standards." No. 281. A study of the inductance of four-terminal resistance standards. Washington: Department of Commerce.

"Science Abstracts. A and B." Vol. XIX. Part 9. September 28th, 1916. London: E. and F. N. Spon, Ltd. Price (each copy) 1s. 6d. post free.

We have received a copy of the first number of *Cheap Steam*, which is a magazine published by Messrs. E. Bennis & Co., Ltd., of 28, Victoria Street, S.W., for establishing closer personal contact with the firm's friends, and as a medium for discussing questions arising in connection with boiler-house practice. There is a biographical article, with photograph, on the founder and managing director of the company, Mr. Edward Bennis, and other contributions deal with plant supplied to a Japanese paper mill, self-starting and self-stopping elevators, the performance of mechanical stokers on a fluctuating load, atmospheric pollution, the care of mechanical stokers, &c., as well as a number of articles of interest to the commercial man.

"British Opportunities in Russia." By L. A. Rojansky. London: The Anglo-Russian Translations Bureau, Ltd. Price 2d.

"Electrical Measurements and Testing, D. and A. C.." By C. L. Dawes. London: Chapman & Hall. Price 3s. net.

"Engineering Applications of Higher Mathematics." By V. Karapetoff. London: Chapman & Hall. Price 3s. net.

"Eclipse or Empire?". By H. B. Gray and S. Turner. London: Nisbet & Co. Price 2s. net.

Electric Lamps for Argentina.—A circular, issued in September by the Compania Argentina de Lamparas Electricas Z, says:—"We have the pleasure to announce that this company has already received 328 cases of machinery, apparatus, and material for the manufacture of metallic-filament electric lamps. These cases have been unloaded from the Spanish ss. *Leon XIII*, and constitute our first consignment from Europe. For mid-October we expect to receive another consignment from the U.S.A. The manager of the company, Senor Eugenio Carrio, and the technical and mechanical staff, arrived on the *Leon XIII*. When circumstances become normal again, a commencement will be made on our great works at Longchamps, F.C.S. In the meantime our factory, workshops, and offices will be situated in the large building purchased by the company, situated at Avenida Alvear and Coronel Diaz, Nos. 2740-50-60, and Cervino, 3227-31, which will permit us, before the end of October, to offer the lamps of our manufacture to the public . . . implying an important departure in favour of national industry."—*Review of the River Plate.*

Trade Announcement.—Messrs. Mason & Brown have removed into their new works—Volta Works, Vestry Street, Leicester—and all communications should be addressed to them there.

Electrical Imports into Pernambuco.—The imports of electrical machinery, supplies, &c., into Pernambuco in 1914 and 1915 were:—

	1914.	1915.
Insulators	£2,042	£243
Machinery	39,991	8,048
Electric motors	2,529	300
Telegraph, telephone posts, bridge and fence material	13,552	4
Lighting apparatus	6,059	1,257

English Porcelain.—It is announced that Messrs. Doulton, of Lambeth, have, after lengthy experiments, succeeded in producing laboratory porcelain, which was, prior to the war, practically a German monopoly. Another development of the Lambeth business is the production of the special porcelain required in connection with the manufacture of sparking plugs.

The Electrical Position in South Africa.—In the course of a recent article, the *South African Mining Journal* says:—"In reviewing the present position, a buyer remarked, the war is anything but over, therefore stocks must be kept up to provide for all eventualities. As regards values, there have not been any fluctuations of any moment during the past month. There is a little weakening of electrical goods, particularly those which copper largely enters into, otherwise there is no sign of the general run of mining material weakening, as freight seems rather inclined to harden. The foundries are all well employed with new work and repairs from the mines, which are giving work out quite freely, as many things cannot be obtained for certain from oversea, and that is where the local makers come in. In this connection the Quasi-Arc system of electric welding process is making much headway in Johannesburg. . . . . At the beginning of the year, electrical materials were scarce; but since then stocks have gradually increased; therefore, Johannesburg is to-day well supplied, and, with a few exceptions, all every-day lines are available. However, the demand is anything but good, as the mines have large stocks on hand and the ordinary town business is exceptionally dull. Electrical bells of the larger kinds in pre-war days came from the Continent, and when those were absorbed considerable inconvenience was often caused in getting the right thing; but now British supplies are coming forward to fill up the gap. In connection with electrical spares, quite a lot is being done in Johannesburg in fixing up cord grip-holders as well as parts for electric torches. It is probable that this industry will continue even after the war. There may be an advance in the price of lamps through increased costs in the manufacture; however, as the stocks in South Africa are at present on the big side, nothing of importance is likely to happen for the next few months."

Catalogues and Lists.—Engineering and Arc Lamps, Ltd., Sphere Works, St. Albans.—Leaflet giving particulars and prices of the "Nevaknot" adaptor for use with electrical apparatus using flexible connections, such as electric laundry and other irons, electric drills, &c. It obviates the difficulty of tangling and ultimate breakage of flexibles. Also an illustrated list concerning fittings for "Half-watt" (nitrogen filled) and metal-filament lamps.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, London, S.W., in issuing a pamphlet giving prices and illustrations of a number of their half-watt lanterns, half-watt and one-watt lamps of various makes, bowl fittings, &c., have included a feature which is of special interest to most of us at the present time. It consists of illustrations, executed in their appropriate colours, of ribbons of honours conferred for distinguished naval, military and civil service, by Britain, France, Russia, Belgium, Prussia and Turkey.

Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, London, W.C.—Forty-page catalogue (No. AB 1), giving illustrations and tabulated prices of carbon materials for the electrical and allied industries—cinema carbons, arc lamp carbons, carbon brushes, battery rods and plates, carbon electrodes, &c.

Messrs. W. Sanders & Co., Falcon Electrical Works, Wednesbury.—Circular containing an illustrated description of their new type of fuseboard, in which the use of all-china and slate bases is obviated.

"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, S.W.—Advertising blotters have been prepared for free distribution to the trade, and numbers can be over-printed with the dealer's name if required.

Bankruptcy Proceedings.—In the course of the public examination of Mr. Tomas Makinson Sanders, civil engineer, of Throgmorton Street, E.C., whose gross liabilities are returned at £27,412, against assets estimated to produce a surplus of £91,627, the debtor said that in 1910 he contracted to purchase, for £350,000, an option for the supply of hydro-electric current in bulk to undertakings in Mexico. Companies were formed, in one of which he received a shareholding of £3,000,000, and arrangements were made for a bond issue of £6,000,000. Owing to the disturbed state of Mexico, the issue had not yet been successful, and in May, 1912, he assigned his interest. At the time he went into that business he was worth a million of money, but he came out of it with only £100,000.

Morse Silent Chains.—Referring to the description in our last issue (p. 380) of a large chain drive employed to transmit 5,000 H.P., and furnished by the Morse Chain Co., of Ithaca, New York, U.S.A., the Westinghouse Brake Co., Ltd., of 82, York Road, King's Cross, inform us that they are the sole licensees outside of the American Continent for the manufacture of silent chains under the Morse patents, and that such chains are manufactured at their works in London.

E.C.C. Hospital Fund.—The employés of the Electric Construction Co., Ltd., Wolverhampton, have contributed £88 10s. to the Wolverhampton and Staffordshire Hospital this year against £70 last year.

For Sale.—Messrs. Denyer & Rumball will sell by auction on October 17th the wireless plant, tools, patents and land at Norman's Bay, Sussex, of Universal Cheap Cables, Ltd., by order of the liquidator. Particulars may be found in our advertisement pages.

The Electrical Co., Ltd.—Messrs. Wheatley Kirk, Price & Co. have issued a bulky catalogue of the stock of the Electrical Co., Ltd., for which tenders must be delivered by Tuesday next. There is a large variety of accessories, including motors and motor parts, small motors, fans, heating and cooking apparatus, dial fuse gear, conduit fittings, Sunshine arc lamps, meters, instruments, Siemens carbons, flame and other carbons, Nernst material, Aegma lamps, miniature carbon lamps, &c.

Condensing Plant Contracts.—The Mirrlees Watson Co., Ltd., Glasgow, have recently received orders for 34 sets of condensing plants of varying steam duties up to 130,0[illegible]lb. steam per hour.

LIGHTING AND POWER NOTES.

Aberdeen.—Public Lighting.—A movement is on foot for an improved scheme of street lighting, and Mr. Bell, city electrical engineer, and Mr. Forbes, inspector of lighting, are to report to the T.C. as to the cost, &c. It is proposed to have electric lamps in the principal streets connected with the police office, so that on warning being given the whole of these lamps can be extinguished simultaneously. The difficulty of dealing in the same way with the gas lamps precludes any extension of the public gas lighting.

Australia.—A public meeting of Glen Innes, N.S.W., residents has condemned the action of the Municipal Council in rejecting the electric lighting proposals, and a resolution to obtain a report for further consideration from Mr. J. F. Donoghue, electrical engineer, was carried.

The South Brisbane (Queensland) Municipal Council has endeavoured to obtain an electric supply for lighting and power, in addition to that supplied by the Brisbane Tramways Co. An Order in Council has now been made, granting powers to the City Electric Light Co. to supply electricity to South Brisbane. The Council has the power to take over the supply at the end of five years, and also to ask the Government to appoint a Committee for the purpose of reviewing the charges made for the supply for lighting and power. All mains and lines are permitted to be above ground.

The North Illawarra Council has received offers from the South Bulli and the Corremal-Balgownie Collieries to supply electricity for lighting in the municipality.—*Tenders.*

Ballyconnell (Co. Cavan).—Street Lighting.—The R.D.C. has accepted the tender of the Ballyconnell Electric Co. to light the town until March next.

Barking.—Loan Sanction.—The U.D.C. has received sanction to a loan of £4,250 for mains extensions and plant for a supply of energy to the Cape Asbestos Co.

Bentham.—E.L. Scheme.—The new electric lighting installation was inaugurated last week. Owing to new applications, the works have had to be enlarged, and a new supply feeder has been erected from the generating station at Low Bentham.

Bolton.—Street Lighting.—The Electricity Committee has suggested a joint meeting of the Gas and Electricity Committees to discuss the question of the control and supervision of the street lighting arrangements.

Burton-on-Trent.—The electrical engineer reports that during the past month the number of units sold for lighting, motors, heating, &c., was 322,511, and for traction 50,659, showing an increase of 60,042 in the former instance, and a decrease of 1,168 for traction, as compared with the corresponding month last year.

Carrickmacross.—The Lighting Co. has increased the price of electricity by 2d. per unit.

Colchester.—In view of alleged smoke nuisance, it has been decided to give each stoker at the electricity works a bonus, conditional on satisfactory stoking.

Edinburgh.—Public Lighting.—The Lighting Committee has recently held a demonstration of modified street lighting, using a 50-C.P. metal lamp on each post and alternatively a 100-C.P. lamp on alternate posts, and the former arrangement is favoured. If approved it will be adopted on all car routes where electricity is the illuminant.

Gillingham (Kent).—Price Revision.—From November 1st, the price of current is to be increased from ½d. per unit, plus 10 per cent., for heating, to 1d., plus 10 per cent., and all accounts (except in case of contracts) will be increased 15 per cent., in addition to 10 per cent. already added. The 10 per cent. charged for meters, radiators, cookers, and other hired apparatus is to be discontinued.

Hull.—New Plant.—The Electricity Committee, in view of the growth of the load, has decided to purchase an additional boiler and to apply for sanction to the necessary expenditure.

London. — Bermondsey.— The B.C. has decided to increase the charges for electricity by a further 5 per cent. Coal and cartage account for an extra expenditure of £4,922 for the year.

Manchester. — Profits and Taxes. — At last week's meeting of the City Council, Alderman Ashton moved the following motion :—"That, having regard to the present high rate of income-tax, and to the liability thereto of the profits of the trading departments of the Corporation, a Special Committee of this Council be appointed to review the basis on which the Electricity, Tramways and other Committees have hitherto made annual contributions out of their profits in aid of the city rate, and to make such recommendation in regard thereto as they may consider desirable" The motion was deferred to another meeting of the Council.

Newcastle-under-Lyme.—Price Increase.—The price of electricity for lighting is to be increased to 7½d. per unit, less 5 per cent. discount.

Newport (Mon.).—Market Lighting, &c.—Negotiations are in progress with a firm on the east side of the river for taking a supply of energy estimated on a maximum demand of 300 kw. The Council is recommended to approve a draft agreement with Messrs. Smith's (Newport), Ltd., for a bulk supply. The Markets Committee is to ask the electricity department to install in the Market Hall 12 600-c.p. half-watt lamps, in lieu of the existing arc lamps which the Committee decided should be removed, the hire of the new lamps to be 5s. per lamp per quarter, and the charge for current and maintenance to be 1½d. per lamp per hour, such lamps, however, being intended to be a stand-by in case the lighting of the stalls fails at any time.

New Zealand.—The Public Works statement, presented last month to the New Zealand Parliament, shows that the Lake Coleridge hydro-electric power scheme has attained results beyond anticipation. Three units of generating plant capable of an output of 5,000 h.p. were originally installed. The demand for electricity warranted the installation of two further units, which would bring the output to 10,000 h.p. Arrangements are in hand for utilising the energy for tramway traction and for the operation of machinery in meat works, flour mills, tanneries, dairy factories and other established industries in and around Christchurch. The total expenditure to March 31st was £329,719. Survey and investigation for a comprehensive scheme to serve the North Island has been in progress, and several schemes are under consideration.—*Australian Mining and Engineering Review.*

Ripon.—Prov. Order.—The T.C. proposes to apply to the B. of T. for a prov. order for electric supply in the city and adjacent parishes.

Rotherham.—New Loans.—Application has been made to the Treasury for sanction to the T.C. raising £75,000 for additional electrical plant. The L.G.B. has sanctioned the borrowing of £735 and £3,020 for the purchase of a motor-tipping wagon and a coal and ash conveyor plant respectively for the electricity department. The Electric Light Committee is recommending the Council to purchase land and buildings in Rawmarsh Road, for the extension of the electricity works ; the present owners are willing to postpone the completion of the purchase until 12 months after the termination of the war. The Committee proposes to enter into an arrangement with the Great Central Railway Co. for the provision of a railway siding at the electricity works.

Stockton-on-Tees.—Loans.—The L.G.B. has sanctioned the borrowing of £805 for electricity mains, but is not prepared to sanction loans in respect of mains, £685, and services, £202.

Swansea.—The electrical engineer reported that during the month 1,212 applications for current for heating had been received, which he attributed to the new electrical showroom.

The Harbour Trust is be asked on what terms it will take a bulk supply for dock lighting, &c.; the Trust has its own generating plant.

Stockport.—Application has been made to the B. of T. for consent to the extension of the generating station in Millgate.

It is anticipated that in addition to the new turbine which has just been officially tested, further provision will be needed in the near future. The engine room at the electricity work has been so designed that two further turbines can be installed when necessary.

Tasmania.—Electricity from the Great Lake scheme was supplied to the Hobart City Tramways and for street lighting on August 13th, and general use of the energy for power and lighting commenced on August 14th. The city is 65 miles from the power house, and the scheme is working satisfactorily.—*Tenders.*

Wadebridge.—Street Lighting.—The U.D.C. has decided to extend the contract for public lighting with the electric lighting company for three years, provided, on account of restricted lighting, the price is reduced by 15 per cent. whilst the present conditions are in force. The company had offered a 10 per cent. reduction.

Waterford.—Suggested E.L. Scheme.—At a Corporation meeting, the Mayor stated that Mr. W. F. Peare, acting on the borough surveyor's suggestion, had communicated with several companies as to the installation of a public electric lighting system in the city, and one of the largest companies had sent a representative, who had inspected the whole area, and had stated he was prepared to recommend an offer. This gentleman was told, the Mayor added, that the Corporation had no money to spend on the scheme, and the company should be prepared to finance it on behalf of that body.

Wigan.—Breakdown Report.—The Special Committee appointed to inquire into the breakdown at the electricity works last December, has submitted its report. It concludes that the boiler failures were due to the use of canal water for feed purposes, the unsuitability of which had been demonstrated to the Electricity Committee from time to time during the past eight years ; to the inefficient or non-cleaning of the boilers ; and the insufficiency of the boiler-plant capacity. The only remedy adopted had been a water-softening plant, and an expert report on this seemed to show that it was inadequate for the work, and that lime and magnesia were getting through it to the boilers. A series of recommendations are made, including one regarding the use of town's water. The Committee appears to place all the blame on the ex-chief engineer, although it seems evident from the report that the Committee was equally to blame.

Worcester.—Severn Fishery Board and Water Power. —Plans have been submitted by the Corporation in connection with the development of the Powick water-power plant, to the Severn Board of Conservators. The Board is opposed to the suggested further development as being prejudicial to the fishing, and is to ask the Board of Agriculture and Fisheries to withhold its consent to any raising of the weir, and otherwise to oppose the scheme.

The Electricity Committee recommends the T.C. to purchase ten 60-kw. transformers and switchgear for same, and to apply for sanction to a loan of £1,000 for this purpose. It was intimated that the great increase in power demand rendered this necessary.

TRAMWAY and RAILWAY NOTES.

Australia.—The Bill to sanction the construction of a high-level cantilever bridge across Sydney Harbour has passed its second reading in the N.S.W. Parliament. It will be possible to carry out the preliminary work in conjunction with the city railway, but the bridge will not be built under existing war conditions.

Melbourne Suburban Railways Electrification. — Mr. Jones, the Railways Commissioner, in co-operation with Mr. Merz, the consulting engineer, has cabled that arrangements have been made for the supply of certain switchgear and sub-station converting plant which Messrs. Siemens Bros. are unable to supply within the prescribed time, and for the acceleration of the deliveries of plant under other contracts to enable the Sandringham-Essendon line to be operated in January, 1918.—*Australian Mining, Standard.*

Bacup.—Mr. McElroy, general manager of the Manchester Corporation Tramways, has been appointed by the B. of T. to act as Referee in the differences between the Bacup and Rawtenstall Corporations regarding tramway fares and stages.

Birmingham.—Female Labour.—The Watch Committee has decided to sanction the application of the Tramways Committee that girls of 18 years and upwards should be licensed as conductors. Previously the age had been 21.

Another stoppage of the tramway service occurred recently owing to shortage of steam at the power station ; fortunately the cars were only held up for half-an-hour.

Birkenhead.—Annual Report.—The year's working of the Corporation Tramways to March 31st shows total receipts amounting to £73,820, an increase of £7,035 ; total working expenses to £38,833, and a gross profit of £33,987. After deducting sinking fund and other charges amounting to £23,417, a net profit remained of £10,570, an increase of £6,070 on the previous year. The balance has been allocated as follows :—In aid of rates, £4,000 ; reserve fund, £2,000 ; renewals fund, £4,570. The credits to reserve fund now stand at £3,040, and to renewals fund at £27,397. The number of car-miles run was 1,176,951, and the passengers carried numbered 16,676,022. The total income per car-mile was 14·849d. War allowances to employés on active service amounted to £1,589, and war bonuses to £884.

Blackburn.—The number of passengers carried on the Corporation Tramways during the week ended October 4th was 234,875, and the receipts amounted to £1,221. Compared with the returns for the corresponding period last year, these figures show a decrease of 16,864 persons and £86 in receipts.

Darlington.—It has been decided to curtail the tramway service, owing to the shortage of men and difficulty of operating in dark streets. It was mentioned that the receipts were £350 up for the half-year, as compared with the corresponding period last year.

Edinburgh.—Tramway Purchase.—The Tramway Committee has adopted the recommendation to refer all matters in dispute with the Tramway Co. to the arbiter under the lease. The principal point in dispute is the repairs required by the city engineer and the condition in which the lines should be left on the termination of the lease in 1919. The report by experts recommending the electric system of traction has also been before the T.C. With regard to the present difficulties, one of the unfortunate factors of the situation is already in evidence in the shape of an extensive relaying of tramway lines. The company refuses to go

beyond the letter of its agreement in this matter, and is only laying the kind of rail which is necessary for its own system. Heavier rails, it is pointed out, are required for an electrical system, and it would have been an easy matter to have laid the heavy rails forthwith on some arrangement for repayment of the extra cost. The prospect at present is that rails which have only been in use for some three years will, on the expiry of the lease, have to be taken up again.

Liverpool.—Free Passes.—The Corporation Tramways Committee has issued 8,546,067 free passes to soldiers, 240,200 to officers and 153,410 to nurses, representing an expenditure of £41,308.

Halifax.—The T.C. has decided to consider a suggestion that, owing to the severe lighting restrictions, the tramway service be curtailed late in the evening.

Newcastle-on-Tyne.—Assessment.—At the last meeting of the City Council it was announced that the proposal to advance the assessment of the tramway undertaking had been abandoned, the figures to remain at £40,606.

At the Quarter Sessions it was mentioned that the Tramway Committee's appeal had been withdrawn.

Oldham.—Female Inspectors.—The manager has been authorised to appoint four women tramway inspectors, who will check tickets, supervise women conductors, but not regulate traffic. At present 106 women are employed.

Rotherham.—The whole of the sanctions necessary to enable the Corporation to carry out the work of doubling the tramway track in Westgate have now been received. Application is to be made to the B. of T. for sanction to the Corporation paying the cost of purchasing 12 cars from the Oldham Corporation out of the tramway capital account over a short term of years.

Sheffield.—New Cars.—The City Council is recommended to authorise the tramway manager to obtain tenders, at an early date, for 25 additional tramway-cars. The city architect and the general manager are to prepare plans and estimates for additional tramway passenger-shelters.

Stretford.—The U.D.C. is applying to the B. of T. for a further extension of the period limited for the construction of the tramways referred to in Section 31 of the Manchester Corporation Act, 1911.

West Hartlepool.—In response to the L.G.B.'s inquiry as to works likely to be undertaken after the war, the T.C. has decided to include the relaying of the Foggy Furze section of the tramways and the laying of a line on the south side of the municipal buildings.

York.—Restricted Services.—The Tramway Committee has decided to curtail the evening tramway services, and proposes to discontinue Sunday services of 'buses during the winter. This is due to the difficulty in staffing the cars and shortage of labour.

TELEGRAPH and TELEPHONE NOTES.

A Lonely Cable Station.—In *Telegraph and Telephone Age*, Mr. C. W. Person describes life on Midway Island, a landing station for the American cable between San Francisco and Manila. The distance between terminals is 7,300 miles, necessitating relay stations at Honolulu, Midway Island, and Guam; the island is 1,200 miles from Honolulu and 2,600 miles from Guam Island. Midway Island is "a patch of coral sand, 8 ft. above the water and 1½ miles in length and ⅔ of a mile in width," surrounded by a coral reef 5 ft. high and 15 miles in circumference—to which it owes its existence. The island was barren when the first operating staff landed there 12 years ago; the invaders have transformed it into a garden of verdure, have introduced domestic fowls, pigeons, and cattle, and have erected buildings which provide accommodation and recreation rooms, libraries, &c., for a population of 20 men, one woman, and a baby. Garden soil is being gradually imported, the sand being useless for cultivation. The island is visited by a supply ship four times a year.

Automatic Telephony.—An automatic telephone exchange has been opened at Dudley, with accommodation for 500 lines, which can be ultimately increased to 5,000.

Cable Steamships.—The new cable repair ship *Lord Kelvin*, of the Western Union Telegraph Co., said to be the most completely-equipped vessel of her class, with oil-fired boilers, has arrived at Halifax, N.S., after effecting a repair in transit. The c.s. *Minia*, belonging to the same company, has been damaged by fire.—*T. and T. Age.*

Colossal Figures.—On July 31st, the Bell telephone system in the United States owned 19,122,921 miles of wire and 6,290,826 stations.—*T. and T. Age.*

Guatemala.—A U.S. Consul reports that the Telegraph Bureau handled 1,626,866 telegrams and 7,263 cablegrams during 1915, an increase of 267,240 telegrams and a decrease of nearly 2,000 cablegrams. The wireless station at Guatemala was reconstructed and its radius increased, messages being exchanged with Arlington, U.S.A., and plans were discussed as to the possible erection of additional stations at San José de Guatemala and at Puerto Barrios.

Russia.—A wireless station has been established on Dickson Island, at the mouth of the Yenisei, for the purpose of sending meteorological telegrams to the physical observatory in Petrograd.—*Nature.*

Storm Breakdowns.—Some particulars are given in the *Telegraph and Telephone Journal* of the effects of the great storm of March 27th in the Cardiff district. Out of 133 trunk circuits working into the Cardiff trunk exchange, the only circuits left were 16 Newport lines, *which were underground.* New underground cables to Swansea and Pontypridd were on the point of completion, and these were brought into use. The total faults in the district were:—Trunk ends, 348; junction ends, 572; subscribers' line faults, 5,311. Out of 7,346 lines working into 10 exchanges (mainly Cardiff and Newport), 3,826 were working after the storm, and 48 of the small exchanges were temporarily shut down. Of the poles 316 were broken, and 4,766 overturned; 1,290 miles of wire were down. The last subscriber's circuit was restored on August 19th, but a number of faulty trunk and junction circuits are still awaiting the re-erection of routes, there being only a small number of gangs available.

Telephone Operators' Courage.—An article and various notes in the *Telegraph and Telephone Journal* bear witness to the heroic devotion to duty of the telephone staffs at exchanges in districts visited by Zeppelins; even when the buildings shook with the force of explosions near at hand, the service was maintained without interruption, and there was no need to use calming words to induce the girls to remain at their positions. At an exchange on the North-East Coast the windows were blown in, but the service was carried on.

Train Dispatching.—There are now about 135 railway systems in the United States and Canada which have adopted the telephone method of dispatching trains, there being 780 circuits in operation, with 95,000 miles of wire.

Trans-Pacific Wireless.—In the course of a preliminary test direct wireless communication has been effected between the wireless station at San Francisco and the Japanese Government plant at Ochiishi.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

Melbourne.—October 31st and November 8th. Deputy P.M.G. Telephone parts; switchboard; instruments, &c. Schedules Nos. 1,363, 1,364, and 1,368.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

Perth.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

South Australia.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Dublin.—November 2nd. Great Northern Railway Co. (Ireland). Contracts for general stores for 12 months (including several electrical items). See "Official Notices" to-day.

Johannesburg.—Municipal Council. Twelve gross of carbon brushes for electric motors. (Contract No. 178.)*

November 13th. S.A Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

Leeds.—Electric lighting installation for slaughterhouse, &c., of Leeds Industrial Co-operative Society, Ltd., Gelderd Road. Secretary, 10, Albion Street.

Rochdale.—October 18th. 20,000 tons of gas coal, for the Gas and Electricity Committee. Chairman of Gas and Electricity Committee.

Spain.—November 24th. Construction and working, for 60 years, of an electric tramway in Saragossa.—*B. of T. Journal.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—Commonwealth P.M.G.:—

300 accumulator cells, £681.—Unbehaun & Johnstone, Ltd.
Apparatus for telegraph power board, £124.—Edison Swan Electric Co., Ltd.

Victorian Railways Department:—

Motor-generator, &c., for battery charging of baggage trucks, £195; switchboard and connections, £233.—Electric Construction Co., Ltd.
Fuse distribution boxes and fuses for electric equipment, Ballarat and Bendigo workshops, during a period of five years.—W. Lucy & Co., Ltd.
Electric lamps for signal system.—Edison Swan Electric Co., Ltd.
Lampholders for ditto.—Aust. General Electric Co.

N.S.W. Public Works Department :—
Installation of electric passenger lift, Newcastle Hospital, £978.—Standard Waygood-Hercules, Ltd.

The following tenders have been received for power-generating plant for the Queensland Government workshops, S. Brisbane :—
Gardner, Waern & Co., £3,955 (Diesel engine).
Engineering Supply Co. of Australia, £4,975.
Norman, Bell & Co., £6,950.
Brisbane Electrical Co., £7,441 and £7,091. —*Tenders.*

Barking.—U.D.C. Accepted tenders :—
Siemens Bros. & Co.—Cable, £1,914.
General Electric Co., Ltd.—Switchgear, &c., £888.
British Electrical Engineering Co.—Transformer, £611.
Babcock & Wilcox, Ltd.—Chain-grate stoker, superheater, &c., £602.

Croydon.—T.C. High-tension feeder cable to connect the generating station with Southbridge Road sub-station : Callender's Cable & Construction Co., Ltd. (estimated cost of cable and laying, £1,425).

Manchester.—Electricity Committee. Accepted tenders :
Cable.—Callender's Cable & Construction Co., Ltd. ; B.I. & Helsby Cables, Ltd. ; Pirelli General Cable Works, Ltd. ; Liverpool Electric Cable Co., Ltd. ; Western Electric Co., Ltd. ; C. Macintosh & Co., Ltd. ; Johnson & Phillips, Ltd.
Potential transformers.—British Westinghouse E. & M. Co., Ltd.
Current transformers.—Ferranti, Ltd.
C.C. amp.-hour meters.—Chamberlain & Hookham, Ltd. ; Ferranti, Ltd.
A.C. single-phase meters.—Ferranti, Ltd.
C.C. watt-hour meters.—G.E. Co., Ltd.
A.C. polyphase meters.—British Westinghouse E. & M. Co.
Motor starters.—Veritys, Ltd. ; Ferranti, Ltd.
Motors.—Electromotors, Ltd. ; British Westinghouse E. & M. Co., Ltd.
Fuse boxes.—B.I. & Helsby Cables, Ltd.
Switchgear.—B.T.H. Co., Ltd. ; Ferranti, Ltd.
Electrically-driven circulating water pump.—Mather & Platt, Ltd.
Extension switchgear.—Ferranti, Ltd.
Switchboard.—B.T.H. Co., Ltd.

Gas Committee :—
Electrical equipment for No. 1 retort house.—Messrs. Drakes, Ltd.

Tramways Committee :—
Lifting jacks.—Equipment & Engineering Co.

Rotherham.—The Ministry of Munitions having arranged to release a 5,500 turbo-alternator, the Clerk has been instructed to place a contract with the British Westinghouse Co. at £23,700. The tender of the British Niclausse, Ltd., for two water-tube boilers for £13,250 has been accepted. The Committee has decided not to enter into contracts for tramway stores, and has authorised the manager to purchase such goods as are required during the year, also to enter into no contracts for cable during the year ; the engineer is to purchase cable as required.

Sheffield. — Electric Supply Department. Dewhurst's Engineering Co., Ltd., for a supply of steel boiler tubes.

The City Council is recommended to accept the tenders of the undermentioned firms for the supply of spare apparatus necessary to maintain the constant running of the whole of the auxiliary plant required to operate the generating machinery at Neepsend :—
Fuller Electrical & Manufacturing Co.—Motors, £2,373.
Siemens Bros. Dynamo Works, Ltd.—Motors, £664 ; transformer, £2,329.
British Westinghouse Co., Ltd.—Motors, £135.
Dick, Kerr & Co., Ltd.—Motors, £280.
J. P. Hall & Co.—Motors, £70.
Igranic Electric Co.—Motor starters, £210.

The above apparatus is absolutely necessary for the proper working of the plant under present abnormal conditions, and as it is not possible to obtain sanction to a loan on capital account for its purchase, the cost is to be charged to the renewal and special expenditure fund.

The Electricity Supply Committee has accepted the tenders of Messrs. A. Reyrolle & Co., Ltd., for 12 H.T. switches, at £209, and the Chatteris Engineering Co., Ltd., for the electrification of the 20-ton overhead travelling crane at Neepsend power house, at £902.

The Council is recommended to instruct the general manager of the Electricity Supply Department to place an order for 50 tons of electrolytic copper wire bars to be made up into cables as and when required.

The general manager of the Water Department has purchased from Mr. Fred. Spivey a 12-in. electrically-driven pump for £55, and from Messrs. T. Oxley, Ltd., a 100-H.P. motor with starter, cables, &c., for £215.

Sunderland.—T.C. Electricity and Lighting Committee :
Joseph Thompson & Co.—Creosoted redwood troughing.
Everett, Edgcumbe & Co.—Surge arresters.
W. T. Henley's Telegraph Works, Ltd.—Cable.

Walsall.—Electricity Committee. Mid-Cannock slack coal, Messrs. William Harrison, Ltd.

Waterford.—Messrs. W. F. Peare, Ltd., of Waterford, have received a contract for switchboards and wiring for an extensive electrical installation at a national cartridge factory.

Wolverhampton.—T.C. Accepted tenders :—
Gibbons Bros., Ltd.—A new steel roof to the boiler house at the electricity works, £383.
Melville, Dundas & Whitson.—A new crane gantry, £811.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 13th. At 8 p.m. At Holborn Restaurant (King's Hall). Smoking concert.

University College, London.—Wednesday, October 18th. At 5.30 p.m. Public lecture on "Long-distance Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S.

Junior Institution of Engineers.—Wednesday, October 18th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Industrial Lighting by Electricity," by Mr. F. H. Taylor.

Belfast Association of Engineers.—Thursday, October 19th. At 7.45 p.m. At the Municipal Technical Institute, College Square. Presidential address.

Institution of Mechanical Engineers.—Friday, October 20th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "Trials on a Diesel Engine, and Application of Energy Diagram to obtain Heat Balance," by the late Lieut. Trevor Wilkins, to be presented by Professor Burstall.

NOTES.

Foreign Trade.—The September Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	Sept., 1916.	*Inc. or dec.*	*Nine months*, 1916. *Inc. or dec.*
Imports :—			
Electrical goods, &c.	£132,579	+ £25,210	+ £424,665
Machinery	590,947	− 214,640	− 581,429
Exports :—			
Electrical goods ...	397,281	+ 135,193	+ 924,613
Machinery	1,765,218	+ 153,768	+ 254,631

Electric Vehicle Committee.—At the last meeting of the Electric Vehicle Committee, Mr. E. S. Shrapnell-Smith, representing the Commercial Motor Users' Association, was unanimously elected Vice-Chairman of the Committee, and it was resolved to issue an invitation to the Institute of Cleansing Superintendents to nominate a representative to sit upon the Committee.

It was decided to send a circular letter to the British automobile manufacturers and another to the British electrical manufacturers, suggesting that they should consider the question of taking up, after the war, the manufacture of electric vehicles in the case of the first-mentioned, and electrical equipments for the same in the case of the second-mentioned class of manufacturers.

Upon the basis of a communication received from the Recorder of the Standards Committee, Society of Automobile Engineers of America, stating that breakages of charging plugs and receptacles made according to the present standard had indicated the necessity of increasing the length of the outer metal protective casing of the receptacle, and that the American standard design had accordingly been altered by increasing the length of the said outer casing by $\frac{11}{16}$ in. (18 mm.), the Committee decided to suggest to the British Engineering Standards Committee the desirability of altering the British standard in a similar manner. It may be mentioned that the said lengthening of the shell involves no alteration to the plug portion or to the contacts or moulded insulation of the receptacle.

It was mentioned that the loan for the three Bradford vehicles had been granted for a period of only four years, and the Secretary was instructed to write to the L.G.B., asking it, after the war, to consider evidence that the useful life of an electric vehicle is such as to warrant the granting of loans for a longer period than four years.

The question of better charging facilities on the route London to Birmingham was again under consideration ; the Secretary was directed to write to the managers of the electricity supply undertakings at Coventry and Northampton, in order to enlist their assistance in this matter.

The Gilbert Club.—A general meeting of the Gilbert Club will be held on Wednesday, October 18th, at 3.30 p.m., the Right Hon. Lord Moulton, F.R.S., in the chair, for the purpose of winding up the club, the object of its formation having been attained, which was the translation, and issuing to the members, of William Gilbert's "De Magnete." The inaugural meeting of the club was held on November 28th, 1889, under the presidency of the late Lord Kelvin, then Sir William Thomson, and there has been no general meeting of the club since that date. The lamented death of Prof. Silvanus Thompson, F.R.S., the principal founder of the club, renders it advisable to wind up the club, and to settle its affairs as soon as possible.

Using the Canals.—The *Manchester Daily Dispatch* says :—"The old canal packet-boat system, which came into being long before the railways, seems to be enjoying a revival. Government demands, shortage of labour, and other factors have interfered with the expeditious handling of railway goods traffic, and traders have had to put up with repeated and vexatious delays. Many of them have consequently had their goods sent by water. An example of this is to be found in Lancashire, where the canal traffic between Manchester and Wigan is gradually increasing. The products in cloth and yarn of the Wigan factories are collected each night, and early the next morning are in the streets of Manchester being delivered to warehouses. On their return journey the boats carry general merchandise. 'We can beat the railways by days,' said a carrier, 'and there is every indication that, with increased facilities, the trade will develop largely.'"

The *Times*, in a recent comment, says :—"A substantial revival of our inland waterways would be one of the most curious results of what, as far as transport is concerned, is essentially a railway war."

Legal.—Woolley *v.* Watson, Marsh & Co., Ltd.—At Lambeth County Court, before Judge Parry, Thomas Woolley, electrician, claimed, under the Workmen's Compensation Act, compensation for injuries sustained in the course of his employment, the respondents being a firm of electrical engineers, of Brondesbury, N.W. It was stated for applicant that he was a skilled electrician, and on May 4th he was working at Pike's Circuit Cinema, Charing Cross, which was in course of reconstruction. He was running steel tubing through the building to carry the wires, and requiring some tubing, he went to get it from the back of the premises. On the way, he met Wilson, the foreman, who stopped him to give some fresh instructions to run three instead of five points. As they were talking, a man came along with a barrow of cement, and as he passed where they were standing, the barrow slipped, and a bag of cement fell on applicant's knee, knocking him down. He was picked up by the foreman, and taken by Mr. Marsh in a taxicab to the hospital. He had been unable to work since, and could neither kneel nor climb ladders. His wages averaged £2 4s. 2d. a week. He had been sent 9s. 10d. for the time he worked up to the day of the accident.

Evidence for the plaintiff having been given, the case for the respondents was stated. They said that applicant had left off work for them when the accident happened, and was assisting the labourer, who was working for another firm, with his barrow, and therefore the accident did not arise out of or in the course of his employment.

Judge Parry said he accepted the plaintiff's account of the accident, as he did not think he was helping with the barrow. Had he been doing so, the respondents could have called the man in support of their story. He deprecated all these quibbling points that were so often raised in cases of this kind. He made an award for the applicant of £1 a week from the date of the accident, with costs.

Northern Counties Electric Supply Co., Ltd., *v.* Steel.—At Morpeth County Court on 9th inst., David Steel, carrier, was sued by the Northern Counties Electric Supply Co. for £2 13s. 3d., for damage alleged to have been caused to a lighting standard at Ashington.—Mr. W. S. Burton, for the plaintiff company, said the claim arose out of a collision between a petrol wagon belonging to the defendant, and driven by him, and an electric light lamp-post. The defendant's wagon ran against the post, damaging it, and so causing it to become "alive"; a boy, who came into contact with it, received a shock.—Fred. Beattie, chemist, Ashington, said he saw the wagon collide with the post, and bend it.—The defendant said he never knew until afterwards that he came into contact with the post, but he now accepted Mr. Burton's statement.—Judgment was entered for the amount claimed.

Electricians Fined.—At the Belfast Munitions Court, on Monday, W. R. Kubler and Lennox Morton, electricians, and E. Dalzell, apprentice electrician, were charged with playing cards and neglecting work during working hours. The defence was a denial of the charges. The Court, however, convicted the men, and fined Kubler 50s., Morton 40s., and Dalzell 10s., the amounts to be deducted from their wages.

Institution and Lecture Notes.—Association of Supervising Electricians.—The following is the programme of meetings for the coming session :—

Tuesday, October 31st.—"Electric Heating and Cooking," Mr. A. F. Berry.
Tuesday, December 12th.—"Electric Meters," Mr. J. Rennie.
Tuesday, January 16th, 1917.—Half-yearly meeting and informal discussions.
Tuesday, February 27th.—"Modern Power Cables," Mr. H. Savage.
Tuesday, April 23rd.—"Wiring Rules of the I.E.E.," Mr. W. R. Rawlings.
Tuesday, May 8th.—"Motor Control Gear," Mr. J. T. Mould.
Tuesday, June 26th.—Annual general meeting.

Belfast Association of Engineers.—The programme for the 1916-17 session includes the following arrangements :—

October 19th.—Presidential Address, Mr. Stanley Johnston.
December 21st.—"Water Power in Ireland," Mr. A. W. Brown.
January 18th, 1917.—"Electric Lifts for Land and Shipboard," Mr. C. G. Major.
February 15th, 1917.—"Liquid Air," Mr. E. A. S. Swinson.
March 15th.—"An Anticipating Governor for Marine Engines," Mr. A. Kerr.
April 19th.—"Engineering Notes on a Tour in the Antipodes," Mr. J. H. Chambers.

Association of Municipal Authorities.—At the fifth annual Conference of the Association, in Belfast, last month, Mr. P. J. M'Andrew read a paper on the development of the water power of Ireland for industrial purposes, stating that they had only to utilise their water power to supply power cheaply to factories, railways, tramways, farming, and other purposes, in order to place Ireland amongst the leading manufacturing centres of Europe. Having studied the economic conditions prevailing, he had decided to bring before the public bodies of Ireland the necessity of putting pressure upon the Government to grant facilities for passing the Irish hydroelectric schemes through Parliament. He had prepared a report on the water-power available on the Rivers Shannon and Erne, which contained the approximate cost of harnessing the powers in those rivers, as well as the approximate revenue to be derived from the supply of power for lighting and industrial purposes. That report had been investigated by one of the strongest financial groups in London, and their expert had recommended the scheme to them. Application had been made to the Treasury for permission to register a company to make the necessary detailed survey, and a large sum of money had been spent on that survey by a large staff of engineers. His report had not only been proved correct, but the result of the surveys proved the scheme to be considerably better. He could not give details of the scheme, for obvious reasons, but he could tell them that there was 50,000 H.P. available in each of the Rivers Shannon and Erne for eight months of the year, and that it varied from 20,000 to 40,000 H.P. each for the remaining months. Unfortunately, they had been debarred from proceeding with the Bill last Session, in consequence of an order made by the Board of Trade stating that no private Bill would be allowed to proceed. In conclusion, he impressed upon the representatives present the absolute necessity for a determined effort to bring the "Irish hydroelectric" into being.

Junior Institution of Engineers.—The activities of the winter session commenced on Friday last, when Mr. E. Eade opened the series of Friday evening "informal discussions," taking for his subject, "Stability and Use of Cranes under Working Conditions." During October, similar lecturettes will be given on "Principles and Application of the Oil Engine," by Mr. W. H. Abrahams; and "Time-saving as a Science," by Mr. A. H. Stanley. The ordinary monthly meeting will be held on Wednesday, October 18th, when Mr. F. H. Taylor will read a paper on "Industrial Lighting by Electricity." A special series of five lecturettes will be given on alternate Friday evenings, from October 20th, by Mr. E. F. Etchells, on "A Common-sense Notation for Engineers"; "The Practical Use of Units in the Evaluation of Formulæ"; "How to Memorise Formulæ"; "Logic of the Differential and Integral Calculus"; "Practical and Illustrative Examples of the Application of the Newer Concepts."

Australian Science Meeting Abandoned.—According to an Australian exchange, it has been decided, owing to the war, not to hold the Hobart meeting of the Australasian Association for the Advancement of Science, which had been arranged for January, 1917.

Registration of Firms Bill.—The Wholesale Traders' Association held a conference yesterday with a view to urging the Board of Trade to secure early dealing with the Registration of Firms Bill in the Commons. It will be remembered that the House of Lords passed a Bill some months ago.

Volunteer Notes.—First London Engineer Volunteers.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 16th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, October 17th.—School of Arms, 6—7. Lecture, 7.15, "Duties in Camp and Quarters," Company Commander Hynam. Range Practice.

Wednesday, October 18th.—Instruction Class, 5.45. Platoon Drill, Platoon No. 2. Range Practice.

Thursday, October 19th.—Platoon Drill, Platoons Nos. 5 and 6. Range Practice.

Friday, October 20th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, October 21st.—N.C.O.'s Class, 2.30; Company Commander Hynam.

Sunday, October 22nd.—Entrenching.—Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

Macleod Yearsley, *Adjutant.*

October 14th, 1916.

3rd (Old Boys') Corps) Batt. County of London Volunteer Regiment.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Thursday, October 12th, 1916 :—

Week-end Parade.—There will be no Entrenching duty on Saturday and Sunday, 14th and 15th inst. Members will receive instructions from their Company Commanders for Sunday duty.

Recruits and Attestation.—The Officer Commanding will be at Headquarters, Lord's, on Mondays, Wednesdays and Fridays, to enrol Recruits, at 6-7 p.m., and also to attest any members who have not already attested.

The Commandant will be present at Lord's Cricket Ground on Saturday, 14th inst., at 3 p.m., to examine Recruits, with a view to dismissing those who are efficient from Recruit Drill.

Recruits will parade at Lord's Cricket Ground on Saturday, at 2.45 p.m., and on Sunday, at 11 a.m. and 2.30 p.m., for Recruit Drill.

G. H. F. Duncan, *Acting Adjutant.*

Appointment Vacant.—Temporary station superintendent for Redditch U.D.C. electricity works (£3). See our advertisement pages to-day.

Prohibited Exports.—A supplement to the *Board of Trade Journal* of October 12th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from British India, Canada, New Zealand, South Africa, Newfoundland, Egypt, Malta, Cyprus, Mauritius, and Ceylon. The Supplement may be obtained from the usual sale agents for Government publications, price 3½d., post free.

Educational.—Northampton Polytechnic Institute.—Classes for engineer salesmen and other technically-trained men on the commercial side of Electrical Engineering have been arranged for the coming session. Particulars will be found in our advertisement pages to-day.

British Chemical Industry.—Sir Charles Bedford, general secretary of the Association of British Chemical Manufacturers, opened the session of the Edinburgh Section of the Society of Chemical Industry last week with an address on the "Organisation of British Chemical Manufactures." He said the necessity for combination for mutual protection and extension of the chemical industry had been increasingly realised of late years; in view of the recent combination of all the German chemical firms, with the object of waging such an industrial war after the war as would suffice to recover, consolidate, and extend their hold over the world's chemical industries, it was necessary to counter such plans, and in other ways to develop and protect the industries of the British chemical industry. It was for that reason that the Manufacturers' Association had been formed. Most of the leading chemical firms in the country were already members of it, and a strong council had been formed. The members were selected on grounds of personal fitness, and in no way as representative of the largest interests alone. A quite mistaken impression had got abroad in certain parts of the country that this new Association was a large capitalist combine, and that smaller firms were not particularly wanted. Nothing could be further from the truth. Assistance to new industries and a large increase in productiveness of essential and "key" industries was a feature of the Association's work, and they would also take concerted action regarding legislation affecting the industry, including patent law reform. Co-operation between the manufacturers and the Universities and the technical institutions would be another sphere of their activities.—*Morning Post.*

Science at Oxford.—In Convocation at Oxford, on Saturday, Dr. T. B. Strong, the Vice-Chancellor, said that about 10,500 members of the University were serving in the Army and Navy, and nearly 500 were in Government employment in other ways. Referring to the statute concerning the Honour School of Chemistry, he said it was an attempt on the part of the University to meet one of the educational needs which the war had brought to notice. They had neglected sadly the claims of natural science in education, and they must in some way remedy this. It was not merely that they wanted to produce more advanced students of natural science; they wanted everybody, including the average people, who would now be advanced students of anything, to be aware of, or in some degree to understand, the scientific point of view. He did not think this would be easy, because it would mean in the end a great psychological change in the nation; they would have to give up the profound distrust of expert knowledge which prevailed so widely among them. At the same time, it was, perhaps, legitimate to express the hope that if they set out on this adventurous course of reform, they would proceed on their own lines, and not attempt to import German methods and German rigidity of type into their system of education without serious and deliberate criticism. The knowledge that was most necessary of all, if the Empire was to continue and prosper, was the knowledge of men.—*The Times.*

Trade Policy for After the War.—Questions were asked in the House of Commons on Tuesday concerning the arrangements to be made to carry into effect the recommendations of the Paris Economic Conference. Mr. Bonar Law said that the Expert Committees which had been appointed to advise the Board of Trade had made considerable progress with their investigations, and Lord Balfour's Committee on British commercial policy after the war was sitting, and would be able to issue an interim report in a "very moderate space of time." Progress had been made with a view to safeguarding important key industries, but he was not yet in a position to make an announcement on the subject. Sir E. Carson asked whether any legislation would be introduced to prevent, in the event of peace, the dumping of German goods. Mr. Bonar Law, in reply, said that he had not looked into that matter. It might be necessary, but that particular point had not yet been considered.

Sunday Labour Stopped.—Recent investigations into the question of "Industrial Fatigue," a report on which was published last week, have shown that Sunday labour and overtime generally are detrimental to output, owing to the lack of opportunity to recuperate from fatigue. The Minister of Munitions has, therefore, decided to prohibit Sunday work where possible.

Board of Trade Reorganisation.—Mr. Runciman informed the House of Commons on Tuesday that he had decided to combine the existing Commercial Intelligence Branch of the Board of Trade and the Exhibitions Branch in a new and enlarged Commercial Intelligence Department. The reorganisation is now proceeding.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Hartlepool T.C. has decided that the salaries of the two station superintendents be increased to £175 10s. per annum, inclusive of war bonus, and that an additional sum of 1s. weekly in the way of bonus be made to the employés of the Electricity Committee.

Mr. E. Grime, of Leyton, has been appointed station superintendent at the Barking U.D.C. electricity works (in the place of Mr. W. Fraser, who had obtained the position of chief electrician of the National Shell and Projectile Factories), at £160 per annum.

Mr. Bullpitt, who was shift engineer at the Barnes U.D.C. electricity works, has been gazetted second-lieutenant.

Mr. John B. Morgan has resigned his post of electrical engineer to the Horsham U.D.C., having accepted the post of works manager to Messrs. H. & E. Lintott, electrical and mechanical engineers and ironfounders, of Horsham. He will take up his new duties on January 1st.

Mr. A. M. Simpson, A.M.I.E.E., has taken over the management of the Malta Tramways, which are owned by Messrs. Macartney, McElroy & Co., Ltd., and he will be glad to receive lists from firms dealing in tramway supplies. His address is Tramway Building, Porta Reale, Valletta, Malta.

General.—At a recent board meeting of the British Thomson Co., Ltd., electrical engineers and manufacturers, of Rugby, Mr. J. F. Nauheim retired from the chairmanship as from September 30th, 1916. The managing director, Mr. H. C. Levis, was appointed chairman of the board, and also retains the managing directorship of the company.

Mr. W. A. Tookey, M.I.Mech.E., has changed his address from 212, Upper Thames Street, E.C., to 39, Victoria Street, Westminster, S.W.

Coun. James Jackson has been appointed chairman of the Bolton Electricity Committee for the remainder of the current financial year.

On September 28th, at Newhaven, Second-Lieutenant W. S. Browne, R.E. (T.), London Electrical Engineers, of the electrical department, Central Argentine Railway Co., was married to Miss Kathleen Spencer, daughter of Mr. and Mrs. B. Spencer, of London and Newhaven.

Roll of Honour.—Lieutenant M. McNay, a member of the firm of McNay & Sons, electrical and general machinery merchants, of Middlesbrough, has been wounded.

Captain W. A. Douglas, Royal Scots, who was killed in August, was an electrical engineer, and a member of the firm of Messrs. James Gray & Son, ironmongers and electrical engineers, Edinburgh. He was 26 years old.

Mr. E. J. Lee, who was formerly in the employ of the Woolwich B.C. electricity department, has been awarded the Military Medal.

Lieutenant S. H. Bill, who up to joining the Navy a few months ago was electrical engineer under the Ilkley District Council, has been wounded.

Corporal W. Bellamy, Bedfordshire Regiment, who enlisted in September, 1914, whilst with the Western Electric Co., has fallen in action in France, aged 20 years.

Second-Lieutenant T. P. Wilson, Bedfordshire Regiment, who enlisted in the Army Service Corps in December, 1914, whilst at Faraday House, London, has fallen in action in France at the age of 23.

Private A. Parker (27), Border Regiment, who has been wounded, was formerly employed in the accountant's department (electricity) at the Manchester Town Hall.

Lieutenant Frank A. Eve, Canadian Infantry, who died of wounds on September 15th, was, according to the *Times*, engaged for a time in telephone construction work in Canada. When the war broke out he joined the Canadian Infantry, and he served for a year at the front.

The War Office announce that Second-Lieutenant W. Reginald Goffe, Oxford and Bucks Light Infantry, who had been missing since July 30th last, was killed in action on that date, aged 29 years. He was on the staff of the St. James's and Pall Mall Electric Light Co., Ltd., and was a promising engineer. His father, Mr. Edward Goffe, A.R.I.B.A., a partner in the firm of Henry Dawson & Son, architects and surveyors, 122, Cannon Street, E.C., also passed away on the 24th ult.

The *Times* states that Captain Keith Lucas, Sc.D., F.R.S., of the Royal Flying Corps, who died as the result of injuries received in a collision of aeroplanes on October 5th, was a director of the Cambridge Scientific Instrument Co. He was 37 years of age, and was elected F.R.S. in 1913, being invited to give the Croonian Lecture to the Society even a year before his election. Before the war he was fully engaged in both teaching and research work at Cambridge, but he put aside all his interests in order to devote his rare instrumental skill and inventiveness to the Air Service. He is described as one of the most promising physiologists of the younger generation.

Private W. Lissamer, Oxford and Bucks Light Infantry, aged 23, who has fallen in action, was with the British Thomson-Houston Co., Ltd., Rugby.

Private Reg. Bartlett, who was with the British Thomson-Houston Co., Ltd., has fallen in action. He had been previously wounded four times.

Lance-Corporal G. W. Bentley, formerly an inspector for 12 years with the Potteries Electric Traction Co., aged 46, has fallen in action. He went to Brisbane in 1912, and joined the Australian Contingent in August, 1915.

Private Chas. W. Tew, Grenadier Guards, who enlisted whilst a stator winder with Messrs. Siemens Bros. Dynamo Works Co., Stafford, has been wounded.

Sergeant W. B. Hill, London Regiment, who was prior to the war on the staff of the City of London Electric Light Co., has been wounded in action.

Corporal E. F. Woodland, of the Ilford U.D.C. electricity works staff, reported missing, is a prisoner of war in Germany.

The Military Medal has been awarded for gallant conduct on the field to Private Charles Lear, Devonshire Regiment, who enlisted whilst a conductor on the tramways at Torquay.

Private J. A. Scott, South Staffs. Regiment, formerly a driver on the Dudley and Stourbridge Tramway, has gained the Military Medal for bravery and devotion to duty.

Sergeant H. W. Atkinson, Duke of Wellington's Regiment, aged 44, who has been killed in action, was employed by the United Electric Car Co., Preston.

Private Harry Greenwood, of the Lancashire Fusiliers, aged 21, who has died from wounds received in action, was formerly employed at the Back o' th' Bank Electricity Works, Bolton.

Obituary.—Mr. Percy Webberley.—We regret to record the death of Mr. Percy Webberley at his home at Longton, Staffordshire, on 6th inst., at the early age of 37. Mr. Webberley was the assistant electrician in the Board of Trade Electrical Standards Laboratory from August, 1908, until June, 1915, when he retired through failing health. He was educated at Mason University College, Birmingham, 1896-1899, where he took the Electrical Engineering Diploma. He was an improver at Messrs. Belliss & Morcom, and acted for some time as assistant in the electrical engineering department of the Northampton Institute, Clerkenwell. After this he was employed in the Westminster Electric Supply Corporation for four years in testing and maintaining instruments in the generating station, under Mr. C. O. Grimshaw, during which time he took first place in laboratory work in the electrotechnics examination, and second in the theoretical work at Finsbury Technical College. He matriculated at the London University in 1902. He was selected from a considerable number of candidates for the post in the Board of Trade on account of his knowledge of electric meters and of electrical measurement and testing. He was a careful and accurate worker and a genial and attractive colleague.

Mr. Tom Dickinson.—News has been received from Australia of the death of Mr. Tom Dickinson, consulting electrical engineer. Deceased served his apprenticeship with Messrs. Armstrong, Whitworth & Co., at Elswick, and, emigrating to Australia in 1888, was appointed manager of the Melbourne Hydraulic Co. Two years later he became secretary and engineer of the Sydney and Suburban Power and General Engineering Co., a position which he resigned four years ago to take up consulting work. He was 56 years of age.

Ald. J. M. Rennoldson.—Ald. J. M. Rennoldson, "Father" of the South Shields Corporation, died on Sunday in his 69th year. Deceased was chairman of the Electrical Committee, a position he had occupied since the establishment of the undertaking, 20 years ago.

Will.—According to the *Times*, Captain Hugh McKean, Manchester Regiment, of Norwood Hill House, Surrey, late general manager of the Ceara Tramway, Light & Power Co., Fortaleze, Brazil, who was killed in action on July 7th, left £36,344.

NEW COMPANIES REGISTERED.

Celynin Electric Light Co., Ltd. (144,994).—This company was registered on October 4th with a capital of £500 in £1 shares, to take over the business of producers and suppliers of electric light and power carried on by the Rev. D. T. Davies, M.A., H. Evans, R. F. Jones, J. Jones, R. Jones, and W. Lloyd, all of Llwyngwril, Merioneth, as the Electric Supply Co. The subscribers (with one share each) are: Rev. D. T. Davies, M.A., The Rectory, Llwyngwril, Merionethshire; H. Evans, Brynawel, Llwyngwril, Merionethshire, signalman; R. F. Jones, The School House, Llwyngwril, certified teacher; W. Lloyd, Glanafon, Llwyngwril, contractor. Private company. The number of directors is not to be less than two or more than six; the first are Rev. D. T. Davies, M.A., H. Evans, R. F. Jones, W. Lloyd, J. Jones, and R. Jones (all permanent). Qualification, £20. Solicitor: A. J. Hughes, Brecon House, Aberystwyth. Registered by Jordan and Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

"Z" Electric Lamp Manufacturing Co., Ltd.—Mortgage dated September 18th, 1916, to secure £10,000, charged on the company's manufactured stock of lamps at factory, and present and future stock of materials at Southfields, and company's other assets. Holders: H. F. Brown, A. Simpson, and W. H. Cheetham, trading as Kilburn, Brown & Co. at Orient House, New Broad Street, E.C.

Liscard Battery Co., Ltd.—A memorandum of satisfaction to the extent of £10 on September 11th, 1916, of debentures dated April 18th, 1913, securing £2,000, has been filed.

Exchange Telegraph Co., Ltd. (6,152).—Capital, £96,430 in 8,023 "A" shares of £10 each and 16,200 "B" shares of £1 each. Return dated August 11th, 1916. All shares taken up; £10 per share called up on 6,000 "A" and £3 per share on 2,023 "A"; £64,046 paid; £32,384 considered as paid, being £8 per share on 2,023 "A" and £1 per share on 16,200 "B" shares. Mortgages and charges: Nil.

Birmingham District Power & Traction Co., Ltd. (19,077).—Capital, £1,050,000 in £10 shares (35,000 cum. pref., 35,000 pref. ord., and 35,000 def. ord.). Return dated June 1st, 1916. 20,978 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares taken up; £10 per share called up on 20,978 cum. pref., 27,000 pref. ord., and 35,000 def. ord; £829,780 paid; £80,000 considered as paid on 8,000 pref. ord. shares. Mortgages and charges: £403,182.

CITY NOTES.

The Zurich Bank for Electrical Undertakings.

The report of the Bank fur Elektrische Unternehmungen, of Zurich, which is a great German-Swiss investment and underwriting company having a combined share and loan capital of £6,360,000, has just been issued for the year ended with June 30th, 1916. Bearing in mind that the company's interests extend over many countries in Europe, the report states that the influence of the war upon the economic life and trade of nations had become accentuated, particularly through the lack of shipping capacity and the various difficulties in the obtaining of raw materials. The electricity works had without trouble accommodated themselves to the conditions brought about by the war, and were able to meet the increased power requirements of the war industries. In this way, as well as through an augmentation in the number of connections for lighting, a larger consumption and greater receipts had taken place, but, on the other hand, the expenses had considerably expanded, especially in the case of coal. Under these circumstances the advantages of hydro-electric works had for the first time been shown to the full extent. The introduction of summer-time in some countries had already tended to reduce the consumption of energy for lighting purposes. In the case of electric tramways a revival of traffic had been perceived almost everywhere, and the scarcity of drivers and conductors had been gradually almost entirely overcome. A movement had taken place in most countries in favour of raising the passenger fares, and many tramways had already been compelled to do so owing to the growth in the working expenses. The works of the companies in which the bank is interested had not suffered any noteworthy damage through the war. The report remarks that the amount of the advances made to foreign electricity undertakings in so far as these are not established in Swiss francs, as well as the foreign banking credits, had been valued in the accounts at the rate of exchange prevailing on the day when the accounts were closed, whilst the inventory value of the shares had been carefully ascertained on the basis of the Stock Exchange quotations and rates of exchange on the closing day. Apart from the considerable depreciation thereby rendered necessary, the general results were unfavourably influenced by the great loss in exchange on the receipts of foreign dividends and interest, as well as through the non-inclusion of dividends declared but not distributed by a number of foreign companies. The accounts show the following figures:—

	1913-14.	1914-15.	1915-16.
Share capital	£3,000,000	£3,000,000	£3,000,000
Loans	2,996,000	3,360,000	3,390,000
Gross receipts	513,000	483,000	458,000
Net profits	330,000	265,000	258,000
Dividend	300,000	240,000	240,000
Dividend per cent.	10	8	8

The report concludes that the situation of the electricity works in the future also will have to be regarded with reserve, as after so long a period of war the return of national economy to normal conditions will not be accomplished without friction and obstacles arising.

German Electrical Companies.

The directors of the *Télephon Fabrik, late J. Berliner, of Hanover*, recommend the distribution of 25 per cent. for 1915-16, as compared with 18 per cent. in the previous twelve months.

The accounts of *Garbe, Lahmeyer & Co.*, of Aix-la-Chapelle, indicate gross profits amounting to £82,000 for 1915-16, as contrasted with £60,000 in the previous year, the net profits being £28,000, as against £20,000. A dividend of 5 per cent. has been declared, as in 1914-15.

The A.E.G. Unternehmungen, of Frankfort-on-Main, whose various investments include £200,000 in shares of the Felten and Guilleaume Co., report net profits of £33,000 for 1915-16, as against £32,000 in the preceding year. It is proposed to pay a dividend of 6 per cent. on the ordinary share capital of £500,000, being the same rate as in 1914-15.

The report of the *Isaria Zahler Werke, of Munich*, states that many difficulties were experienced in 1915 in the produc-

tion and export of electricity meters. As net profits the accounts show the sum of £21,000, as contrasted with £26,000 in 1914, and a dividend of 10 per cent. is proposed, as in the preceding year. The share capital is to be increased by £15,000 to £125,000; the orders on hand are said to be satisfactory, although those for Army requirements do not reach the capacity of the works.

The Elektrizitats A.G., late H. Poge, of Chemnitz, reports gross profits of £167,000 in 1915-16, as compared with £76,000 in the preceding year. After defraying general expenses, interest charges, and placing £22,000 to depreciation, as against £16,000 in 1914-15, the accounts show net profits of £88,000, as contrasted with £21,000. It is proposed to pay a dividend at the rate of 15 per cent., this comparing with 7½ per cent. in the previous year. The directors state that the orders on hand represent an increase over the corresponding period in 1915.

The report of the *Kabelwerk Rheydt A.G., of Rheydt*, states that the company was well occupied in 1915-16, particularly in the rolling mill works. It could, however, not be foreseen whether the present still satisfactory state of activity would continue. The stocks and debts owing had been very carefully estimated, as the conditions which would arise after the war were uncertain. The accounts exhibit gross profits of £255,000, as against £175,000 in 1914-15. After providing for general expenses, &c., and allocating £61,000 to depreciation, as contrasted with £25,000, the net profits are returned at £184,000, as compared with £140,000. The dividend is 30 per cent., as against 18 per cent. and 12 per cent. in the two previous years respectively.

Quebec Railway, Light, Heat & Power Co., Ltd.—The gross earnings from all sources for the year ended June, 1916, were $1,968,601, an increase of $184,527. The operating and maintenance expenses were $1,029,750, an increase of $104,934. The fixed charges and taxes were $723,447, leaving a net surplus of $215,403, which added to the previous surplus, leaves a total surplus to date of $562,903. There was expended on maintenance during the year $220,603.

Monterey Railway, Light & Power Co.—At a meeting of 5 per cent. first mortgage debenture stock holders in London, last week, resolutions were passed appointing a committee to protect the interests of the bondholders, and assenting to the creation and issue of prior lien charges to the tune of 10 per cent. of the existing debenture stock.

Mexico Electric Tramways, Ltd.—At a meeting of the holders of the 5 per cent. first debentures, held on Tuesday in London, a resolution was passed deferring the interest due at July, 1916, and January, 1917, until July, 1917.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year to June 30th at the rate of 5 per cent. per annum, free of income-tax.

Stock Exchange Notice.—The following securities are to be quoted in the Official List:—

Underground Electric Railways Co. of London, Ltd.—£15,000 additional 6 per cent. income bonds of £100 each, Nos. 30,072 to 30,221.

Oriental Telephone & Electric Co., Ltd.—Interim dividends declared:—3 per cent. on the 6 per cent. cum. pref. shares for the current year, less income-tax; 4 per cent. on the ordinary shares, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The first effects of the offer of 6 per cent. Exchequer Bonds may now be said to have worn off. Investors are familiarised with the new rate of interest; and the competition of this, and of the French National Loan, is fully recognised in all of the investment departments. Further falls have taken place in the market for Home Railway prior charge stocks. Metropolitan 3½ per cent. preference of both classes, for instance, is 2 points down on the week. The three Central London assented stocks—ordinary, preferred, and deferred—have fallen to the common level of 70, showing declines of 1–3 points.

Much talk is in the air of raising the military age limit, and this in itself is a deterrent upon commercial enterprise so far as the Stock Exchange is concerned. At the same time, the Board of Trade returns for September made a wonderfully good showing. There is plenty of money awaiting investment, and hints which have all the appearance of inspiration have begun to peep out in the Press concerning the probability of the public being able to exercise the option which they were given through the purchase of the 4½ per cent. War Loan—an option extended to the new Exchequer Bonds.

The opening of Parliament this week was expected to produce some sort of statement on the point, so the cat may be out of the bag before these lines are in print. If the Chancellor of the Exchequer or the Prime Minister, whoever may be the responsible party, fulfilled the obligation afforded in the issue of the 4½ per cent. War Loan, he would give a big impetus to subscriptions to the present Exchequer Bonds, and would impart a greater feeling of confidence to other markets as well.

The drop in the price of Central London stocks we have already mentioned. It seems a little curious that preferred, deferred, and ordinary stocks should all be standing at the same price; and the obvious inference is that, so far as the security is concerned, there is little indeed to choose between the stocks. At the present level, the return is still under 6 per cent. on the money. The market in the Steam stocks is inclined to harden up a little, except in that section devoted to the gilt-edged issues, which is overshadowed, of course, by the competition of the Exchequer Bonds. The optimist points to the recent statement that the Government will take the responsibility for the additional war bonus granted to the railwaymen, but it cannot be pretended that there is any public demand for railway stocks at present.

Metropolitans and Districts improved, and the latter retain their advance, Metropolitans, however, sagging back to their previous price of 23¼. Underground Electrics are rather better, the 6 per cent. income bonds gaining ½, and the shilling shares hardening to 6s. In the prior charge group, Metropolitan 3½ per cent. preferences have gone back to 60.

The shares of electrical companies working at home are disposed to improve. County of London are good at 11, and St. James's have risen to 6¼. On the other hand, Metropolitans are a trifle down at 2⅜, notwithstanding the amicable arrangement reached at the recent meeting. There is a steady demand for the principal shares, and this, of course, is the season of the year in which all investments connected with illumination usually receive a little favourable attention. The trouble is, as we have pointed out so frequently on previous occasions, to get any adequate supply of shares to satisfy the demand for them.

The telegraph market is weaker on the whole, there being falls in Great Northerns, Western Telegraphs, Eastern Extensions, and Anglo-American Telegraph preferred. So far as the American stocks are concerned, these have weakened in consequence of the latest outbreak of submarine activity off the coast of New York. This has given rise to uneasiness in American circles, being an unexpected development in the situation, and most securities connected with the other side of the "pond" have given way.

In regard to the dulness in other parts of the cable section, this would appear to be due to a slight pressure to sell on account of executors; while the issue of the Exchequer Bonds and the French National Loan naturally weigh against such purely investment stocks as those in the Telegraph list. It is worth pointing out, however, that the returns on Eastern Telegraph, Eastern Extensions, and Western shares, averaging about 5½ per cent. on the money, are equivalent to 7¼ per cent. yields paid less tax.

In which connection it may be useful to remind holders of stocks and shares, the dividends on which are paid free of tax, that this does not preclude them from claiming return of the tax in such cases as those in which they are entitled to do so. For instance, a holder of £100 Eastern Telegraph ordinary stock, who receives £8 per annum, has the right to reclaim about £2 10s. in respect of this dividend, supposing that he is not liable for income-tax at all. With income-tax standing at a reasonable figure, of course it is scarcely worth while to go to the trouble of reclaiming a portion of the tax; but when it comes to 5s. in the £, the investor who is liable for less than this rate naturally feels inclined to take advantage of whatever rebate he is entitled to. The vouchers attached to the dividend warrants are accepted by the Inland Revenue authorities in claiming in this manner, while as regards Underground Electric Income Bonds, the bankers will give a certificate at the time the coupons are cashed which will have the same effect.

Brazilian Tractions have been a particularly weak market, principally because of the further fall in the exchange and the growing fear that the Republic may have to extend its funding scheme on the Government bonds for a year or two after the date at which it was timed to expire. There have been a good many shares in the market lately; and, with the disfavour attaching to most Brazilian securities at the moment, some of the sellers had to slaughter their holdings. The price touched 55½, but recovered to 57½, at which it still shows a loss on the week of 2 points. Bombay Electric preference have fallen ¼. The Mexican group is weaker. British Columbia Electric issues retain most of their recent big rises; an advance of 2 points has occurred in the 4½ per cent. debenture stock, this attracting attention by reason of the good return which it yields and the character of the security. Calcutta Trams at 6¾ are better. Rio Trams second mortgage bonds gave way to 78, and Sao Paulo, Tramway and Electric, bonds are lower.

British Aluminium ordinary recovered their dividend of 9d. per share, and are quiet at 29s. ex dividend. Other industrials are steady; the dulness in iron and steel varieties is somewhat noticeable. Marconis have lost ¼ at 2 15/16. Americans and Canadians have been depressed with the parent shares.

The rubber share market is firm and active, the outstanding feature still being the large demand from the provinces, which demand London does its best to supply. The price of the raw stuff improved to the level half-a-crown per lb. on the report that some of the boats torpedoed by the U. 53 were carrying a good deal of the commodity.

Amongst copper shares, the tone is decidedly good; and during the past few days a brisk rise in the price of tin, the metal, has attracted attention to the shares of companies dealing with it.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Oct. 10, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary	5	5	8 3/16	—	7 1 4
do. do. do. 4½ Pref.	4½	4½	3 15/16	—	6 6 4
Chelsea	5	4	3	—	6 18 4
City of London	9	8	19½	—	6 10 8
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 15 8
County of London	7	7	11	+ 3/16	6 7 3
do. 6 per cent. Pref.	6	6	10⅜	—	5 15 8
Kensington Ordinary	9	7	5⅝	—	6 4 5
London Electric	4	8	1⅜	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4 9/16	—	6 11 4
Metropolitan	8½	8	2⅞	— ⅛	5 14 3
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	10	8	6¼	+ ⅛	6 3 1
South London	5	5	2 13/16	—	6 16 1
South Metropolitan Pref.	7	7	1 5/16	—	6 7 3
Westminster Ordinary	9	7	6⅜	—	5 12 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100	−2	6 0 0
do. Def.	30/-	33/6	23½	—	7 8 3
Chile Telephone	8	8	7	—	5 14 5
Cuba Sub. Ord.	5	5	8½	—	6 8 6
Eastern Extension	7	8	11 3/16	— 3/16	*5 12 6
Eastern Tel. Ord.	7	8	14 1/16	−1	*5 10 9
Globe Tel. and T. Ord.	6	7	12 9/16 xd	—	*5 11 0
do. Pref.	6	6	10⅜	—	5 11 7
Great Northern Tel.	22	22	40	−2	5 10 0
Indo-European	13	13	49	—	6 12 8
Marconi	10	10	3 1/16	— ⅛	3 8 0
New York Tel. 4½	4½	4½	100	—	4 10 0
Oriental Telephone Ord.	10	10	2 5/16	—	4 6 6
United R. Plate Tel.	8	8	6⅜	—	*5 18 5
West India and Pan.	1	—	1	— 1/16	—
Western Telegraph	7	8	14½	— ¼	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	70	−3	5 14 4
Metropolitan	1½	1	2 1/16	+ ¼	4 4 8
do. District	Nil	Nil	18	+1	Nil
Underground Electric Ordinary	Nil	Nil	1 1/16	—	Nil
do. do. "A"	Nil	Nil	6	+6d.	Nil
do. do. Income	6	6	88½	+ ½	*6 15 7
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4 1/16	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½	5½	3½	— 1/16	7 17 2
do. 2nd Pref.	5½	5½	3	—	—
do. 5 Deb.	5	5	75	—	6 13 4
Brazil Tractions	4	4	57½	−2	6 19 2
Bombay Electric Pref.	6	6	10½	— ¼	5 17 3
British Columbia Elec. Rly. Ptce.	5	5	75	—	6 13 4
do. do. Preferred	—	Nil	61	—	Nil
do. do. Deferred	—	Nil	5½	−1	Nil
do. do. Deb.	4½	4½	99	+2	6 3 2
Mexico Trams 5 per cent. Bonds	—	Nil	43	−1	Nil
do. 6 per cent. Bonds	—	Nil	85	−1	Nil
Mexican Light Common	Nil	Nil	18	—	Nil
do. Pref.	Nil	Nil	33	—	Nil
do. 1st Bonds	Nil	Nil	41	−1	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3 1/16	—	4 18 0
British Aluminium Ord.	5	7	29/- xd	+9d.	5 10 4
British Insulated Ord.	15	17½	12½	—	7 0 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	8½	—	6 6 8
Edison & Swan, £3 paid	Nil	—	10/-	—	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 4 per cent. Deb.	5	5	62½	—	8 0 0
Electric Construction	6	7½	1 5/16	—	8 0 0
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. Ord.	10	10	14½	—	6 15 7
Henley	20	25	16½	—	7 9 2
do. 4½ Pref.	4½	4½	4½	—	5 6 0
India-Rubber	10	10	12	—	*8 3 4
Telegraph Con.	20	20	39½	—	*6 3 0

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	Receipts for the month. £	No. of weeks.	Total to date. £	Total to date. £	Route miles open.	Inc.
Bristol (Trams)	Sept. 29	21,358	+2,619	39	191,960	+ 8,037	30·5	..
Cork	„ 28	2,199	+ 52	39	19,984	+ 196	9·89	..
Dublin	„ 29	86,493	+ 874	39	236,178	— 2,448	54·25	..
Hastings	„ 29	5,881	+ 671	39	42,314	+ 2,715	19·3	..
Lancashire United	„ 27	8,460	+ 365	39	71,246	+ 2,873	42	..
Llandudno-Col. Bay	„ 29	2,424	+ 506	43½	16,575	+ 989	6·5	..
Anglo-Argentine	„ 30	205,844	+8,491	39	1,977,883	— 2,792	..	..
Auckland	„ 22	20,884	+ 613	12	62,868	+ 563	26·69	..
Calcutta	„ 30	18,557	+1,719	39	..	+ 8,707	..	..
Kalgoorlie, W.A.	July	2,521	— 254	31	17,458	— 496	20.5	..
Madras	Sept. 30	4,422	+ 479	39	37,985	+ 2,781	..	..
Montevideo	August	26,044	— 449	43	292,382	+13,936	..	..
Dublin-Lucan Rly.	Sept. 29	686	+ 75	13	2,463	+ 202	7	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	„	£64	..
a Bisulphide of Carbon	„	£23	..
a Borax	„	£34	..
a Copper Sulphate	„	£51	..
a Potash, Chlorate	per lb.	2/6	..
a „ Perchlorate	„	2/-	..
a Shellac	per cwt.	122/-	6/- dec.
a Sulphate of Magnesia	per ton	£16	£2 dec.
a Sulphur, Sublimed Flowers	„	£17	..
a „ Lump	„	£14 10	..
a Soda, Chlorate	per lb.	1/-	..
a „ Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/3½ to 1/3¾	⅛d. inc.
c „ Tubes (solid drawn)	„	1/4½ to 1/4¾	¼d. inc.
c „ Wire, basis	„	1/3¾ to 1/4	¼d. inc.
c Copper Tubes (solid drawn)	„	1/7⅞ to 1/7¾	¼d. to ½d. inc
g „ Bars (best selected)	per ton	£166	£9 inc.
g „ Sheet	„	£166	£9 inc.
g „ Rod	„	£166	£9 inc.
d „ (Electrolytic) Bars	„	£142	£4 inc.
d „ „ Sheets	„	£160	£4 inc.
d „ „ Rods	„	£151	£5 inc.
d „ „ H.C. Wire	per lb.	1/6	¼d. inc.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	2/3	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	3/4	1d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l „ Wire, galv. No. 8, P.O. qual.	„	£36	..
g Lead, English Pig	„	£32 5	..
g Mercury	per bot.	£17 12 6 to £17 15	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/9	¼d. inc.
r Steel, Magnet, in bars	per ton	£95	..
g Tin, Block (English)	„	£182 to £183	£9 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/10	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Acoustic Patents.
British Motobloc Syndicate.
British Tungsten Lamp Co.
Bullough's Adjustable Rail Joint Support Co.
Compagnie Générale Electrique de la Champagne.
Didelon Regulators.
Doncaster Electrical Co
Electrical Advertising Co.
Electric Safety Boiler Cleaner.
Ernest Scott & Mountain.
Glamorgan Tram & Constructional Works.
J. Defries & Sons.
Kevan Electric Co.
Machine Drying & Peat Fuel Co.
Mica Manufacturing Co.
National Lighting Corporation.
Platinum Corporation.

Mexican Light & Power Co.—At a meeting of the holders of the 5 per cent. first mortgage gold bonds, held in London last week, resolutions were passed giving effect to the policy approved in July in conjunction with the bondholders of the Mexico Tramways Co. and others in the group. The chairman said that, after a year's experience, they were more than ever convinced that the policy of central control of all the group of companies, pooling of their resources, and showing a united front, was undoubtedly the right one and, indeed, the only one.

National Telewriter Co., Ltd.—The directors report that the results of the company's operations for the year ended June, 1916, which operations are very considerably hampered by the war, show a slight improvement upon those of the previous year, the net profit, after paying interest on debentures, being £1,020, as against £757 for the former period. The annual meeting was held on Monday.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax at 5s. in the £, making a total of 4 per cent. for the half-year ended September.

Shanghai Electric Construction Co., Ltd.—Interim dividend at the rate of 4 per cent. actual (8s. per share) on the share capital, less tax.

ELECTRICITY SUPPLY IN BETHNAL GREEN.

On Friday afternoon, last week, the electricity supply undertaking of the Bethnal Green Borough Council was formally inaugurated, the Mayor (Mr. Councillor W. J. Lewis) performing the opening ceremony of the New Tyssen Street and Digby Street sub-stations, which, together with the distribution system, constitute the initial equipment of what has long been the only London borough which had no public electricity supply. The undertaking is noteworthy

E.H.T. Control Board, New Tyssen Street Sub-station.

in other ways, being the first "all three-phase system" to be laid out on the lines recommended by Messrs. Merz and McLellan in their 1914 report on London Electricity Supply, although this particular scheme was based on the earlier recommendation of Sir John Snell to the Bethnal Green Council in 1912; it is also of interest to note that it is a purely bulk-supply scheme, fed from the Stepney Borough Council's electricity undertaking, and that the control, management, and maintenance of the distribution is, by agreement, being undertaken by the Stepney authorities.

The Council obtained a provisional order for electricity supply in 1899, and subsequently the late Mr. Robt. Hammond prepared a scheme for a combined destructor and electricity station, which, however, was not carried out.

Sir John Snell's 1912 report recommended the Council to obtain a supply in bulk from some neighbouring authorised distributor, and ultimately the tender of the Stepney Borough Council was accepted, and an agreement entered into for the purchase of electricity in bulk for a period of years, the agreement being subsequently supplemented with a view to the Stepney Council also taking over the management of the undertaking. In the summer of 1914, Mr. H. W. Couzens was appointed consulting engineer to carry out the scheme as suggested, and the work was put in hand, but owing to the outbreak of war and consequent dislocation of business, it has only now been completed.

The contractors for the whole of the cables were the British Insulated and Helsby Cables, while the British Westinghouse Co. supplied the complete sub-station electrical equipment. The bulk supply at 6,000 volts, three-phase, 50 periods, is delivered to the Stepney Borough boundary in Brick Lane by duplicate cables, from which point ·05 sq. in. three-core, lead-covered cables, laid solid, run to the New Tyssen Street sub-station, and continue thence to the Digby Street sub-station; when the load increases in the northern area, it is proposed to construct an additional sub-station in that district.

The sub-station buildings have been designed and constructed under the supervision of the borough engineer, Mr. A. E. Darby; an identical electrical equipment is provided in each, consisting of two oil-cooled transformers—one of 500 K.V.A. and one of 250 K.V.A.—together with the necessary E.H.T. and L.T. switchgear, on opposite sides of the building.

The switchgear is of standard pattern, the E.H.T. cubicles and oil switches, which are hand-operated, being on the floor with the control switchboard on a gallery above; the board is divided into two halves, coupled by means of an interconnector switch, and each half contains an incoming and outgoing E.H.T. feeder panel and a transformer panel, the interconnector panel being in the centre.

The feeder and transformer panels are equipped with relays in connection with the Merz-Price protective gear, which has been fitted, and provides for the instant isolation of a faulty feeder, the supply, of course, being maintained through the duplicate cable.

The L.T. switchboard contains two transformer panels and three outgoing L.T. feeder panels, as well as a station lighting panel, fed back from the distribution. The feeder panels are fitted with ammeters and power factor meters in each phase. Each sub-station is equipped with a 7½-ton hand-operated crane, supplied by Messrs. Higginbottom and Mannock.

Distribution cables have been laid through the main streets of the borough, but only on one side of the street, except in the case of Bethnal Green Road; the L.T. cables are of the four-core lead-covered type, laid solid—the supply to consumers being at 415 volts between phases for power, and 240 volts between each phase and neutral, for lighting. Although Bethnal Green has had no authorised supply in the past, yet a considerable number of consumers on the Shoreditch and Stepney boundaries have received temporary supplies of electricity from those boroughs, pending the availability of the Bethnal Green supply. It is therefore evident that so soon as these consumers' installations can be transferred (unfortunately, in this case, the change being from direct current to three-phase supply, will necessitate the replacement of motors, &c.), the Council will obtain a considerable business. It may be added that Bethnal Green contains a large number of small power industries, to whom a supply of electricity will be a great boon.

Interior of New Tyssen Street Sub-station, Bethnal Green Electricity Supply.

Energy in bulk is supplied by the Stepney authorities at £3 per KW. of maximum demand, plus ¼d. per unit; the primary charge is based on "maximum demand in any one hour," and a coal clause provides for the secondary charge increasing with the cost of coal; the agreement also contains clauses defining power factor and balancing conditions.

As previously mentioned, the Stepney Electricity Department, of which Mr. W. C. P. Tapper is the engineer and manager, will undertake the management of the concern for a period of years.

In conclusion, we are indebted to Mr. H. W. Couzens, consulting electrical engineer to the Council, for his assistance in connection with this description.

THE BRITISH ASSOCIATION.—VI.

The Influence of Pressure on the Electrical Ignition of Methane.

By W. M. Thornton, D.Sc., D.Eng.

(Section G. Abstract.)

The present experiments on the influence of pressure on gaseous ignition have been made with methane, in the mixture 9.5 per cent. in air, which just gives perfect combustion.

There are four kinds of single spark which may be used for experimental ignition, each of which has characteristic features, and all but one of which are in practical use. These are: (1) A transient electro-magnetic impulse, (2) the discharge of a condenser placed across the gap, (3) the short arc formed at the point of breaking a continuous-current circuit, (4) the same with alternating current. The last two differ so much in some of their effects that they have been examined separately. In each of these groups there are sparks which do not ignite the most inflammable mixtures of highly combustible gases and air.

Although an impulsive or jump spark starts by ionisation, usually across a fixed gap, its igniting power has been shown to follow a different law from that of rupture alone. Condenser discharge passes just before metallic contact of two terminals which are being brought together, and when the charging voltage and the poles are the same throughout occurs at the same spark length. It is, however, an exceedingly rapid effect, and it is probable that the ionisation with which it starts is masked by the intense activity of the discharge, so that the ultimate ignition is proportional to its energy or power.

The two circuit-break sparks are less simple. They are streams of electrons following a path which becomes more difficult as the gap opens. The momentum of the electrons of this stream is comparable with that of the molecules of gas around it. The latter, therefore, penetrate the arc, and are exposed to the dissociating influence of its high temperature. The conditions of ignition arise from the collision of the gas with the ions in the arc. The action is no doubt partly thermal and partly ionic; in some cases ignition is proportional to the current, in others, its change is proportional to the current squared. The extraordinary variety of the reaction between gas and spark, indicated by the limiting electrical conditions of ignition, is not to be accounted for on a simple thermal basis.

Ignition by Impulsive Coil Discharge.—Ignition at atmospheric pressure has been shown to have steps which appear, as the percentage of gas is varied, in certain well-defined mixtures. The precise origin of these steps is still obscure, but there can be no doubt that they are examples of selective action which occurs at certain frequencies of collision between the molecules of combustible gas and oxygen. The evidence for this is two-fold. In the first place the steps, either up or down, occur in mixtures in which the proportions of the atomic volumes of the two gases can be represented by whole numbers.

The occurrence of the steps in some gases with one kind of spark, in others with another, clearly depends on an intimate, but at present unknown, relation between the physical or chemical properties of the molecule, possibly on its structure, and the nature or duration of the spark.

Secondly, direct evidence that the steps are due to selective absorption is given by the ignition of hydrogen with alternating-current break sparks. In a mixture of 25 per cent. of gas in air and at a pressure approaching 40 lb. to the sq. in. a step is obtained having the well-known form of fig. 1. This type of change occurs in nature wherever there is selective absorption.

In the present experiments with methane, at pressures lower than atmospheric, the least igniting impulsive spark is measured by the primary current of the induction coil, which, when broken, causes a single secondary spark just giving ignition. This varies with the pressure, as in fig. 2.

The two curves given are with gas prepared by different methods and are seen to agree singularly well when the difficulties of obtaining the same conditions for every spark and precisely the same gas mixture are known. The fact that the steps are so clear is a proof that the selective action is definite and capable of quantitative determination. The collision frequency between combining molecules, or atoms when there is dissociation, can be changed by varying either the total or the partial pressures, that is, either the pressure in the explosion vessel or the percentage of combustible gas in the mixture. The latter has been shown to give rise to steps, and in fig. 3 they are also found by change of total pressure. The reduction of the total pressure by one-half has the same effect on collision frequency as halving the percentage of gas in a mixture at atmospheric pressure.

In fig. 3 it is shown that steps arise from change of pressure at successive multiples of an atmosphere. In the same way they are to be expected at sub-multiples of an atmosphere, ½, ⅓, ¼..., and there is evidence for each of these.

The interpretation of these steps must by the nature of the case be tentative. After consideration of every possible cause this appears to be the only one capable of explaining the facts.

When the mixtures are compressed before ignition there are also steps in the least igniting current curve which are very suggestive. The pressures at which they occur are 1. 2, 3, 4, and 5 atmospheres, absolute, as shown in fig. 3, the abscissæ of which are, however, pressures above atmospheric.

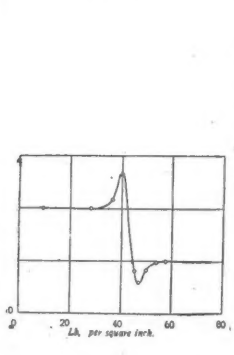


Fig. 1.

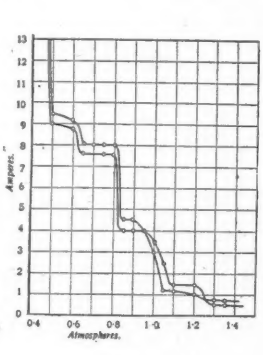


Fig. 2.

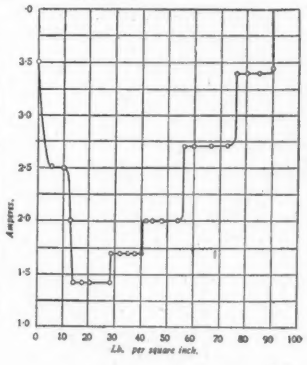


Fig. 3.

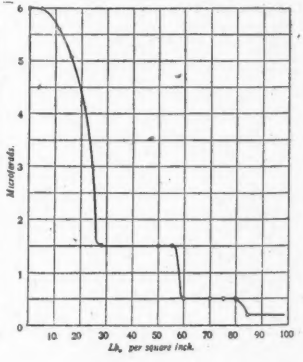


Fig. 4.

Fig. 1.—Change with Pressure of Least Alternating Current Igniting at Break a 25 per cent. Mixture of Hydrogen in Air.

Fig. 2.—Ignition of Methane in Air by Impulsive Sparks, Platinum Points.

Fig. 3.—Impulsive Sparks, Nickel Points.

Fig. 4.—Condenser Discharge, 150 volts, Platinum Points.

From this there can be no doubt that the steps are caused by the collision frequency reaching successive multiples of that at atmospheric pressure. It is, therefore, a physical effect, and will be shown to support the conclusion that in gaseous explosion, collision mechanics of the simplest kind are of importance.

The pressure most favourable to ignition by impulsive sparks is between two and three atmospheres absolute. There is reason to believe that the steps continue to much higher pressures, and this is now being investigated.

Ignition by Condenser Discharge differs from the above in two important features: (1) The least igniting spark is *independent of the pressure* from the lower limit at half an atmosphere to just above one atmosphere, and so forms one step. (The value of the least igniting capacity was 6 mfd. charged to 150 volts, at every pressure down to 0.5 atmosphere, below which ignition by condenser sparks failed completely.) (2) As the pressure is raised ignition becomes *easier* and there are steps, but now down, as 30 lb., 60 lb., and 85 lb. per sq. in. are approached. In fig. 4 there are steps at 1, 3, 5, and 7 atmospheres, but not in this case at 2, 4, or 6.

Apart from their physical interest these results are of some practical importance. The curve of fig. 3 is for ordinary magneto ignition; those of fig. 4 correspond to the Lodge

ignition by condenser discharge, the high effectiveness of which is well known, especially in poor mixtures highly compressed, which cannot be readily ignited by magneto sparks. Electro-magnetic jump sparks and condenser discharge, therefore, proceed in opposite directions, one becoming easier as the pressure is raised, the other more difficult. The former are examples of the relatively slow process of ionisation by collision, which is more difficult at high pressure. Condenser discharge, on the other hand, is one of the most sudden phenomena in nature, and the spark is, in addition, of high enough temperature to pit platinum freely. Most of the energy of the charge is dissipated in the spark. This is equivalent to the combustion of a definite mass of the gas, and the heat of the spark is rapidly communicated to the gas around. If the mass of the latter heated to ignition temperature is equal to or greater than that whose combustion would set free as much heat as there is in the spark, self-ignition can proceed. A short calculation from the observed least igniting capacity will serve to show that there is more than sufficient energy for the purpose, the remainder being absorbed by the poles or radiated, but the ratio of division cannot at present be measured.

Compression increases the mass of gas in contact with a spark of a given magnitude. It follows that at the higher pressures a smaller spark, provided that its energy is given to the gas as heat, should cause ignition.

On this view the product of least igniting capacity and gas pressure would be constant as a first approximation. The occurrence of steps rising as the pressure is lowered is a modification of this by selective collision. The next two kinds of ignition illustrate a smoother type of charge.

Ignition by Continuous-current Circuit Break Sparks.—Below atmospheric pressure the least igniting current is found to increase, so that the product of the current and pressure is approximately constant, until at half an atmosphere there is a sudden and most remarkable increase of inflammability.

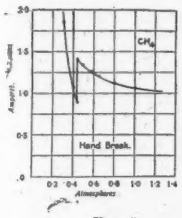


Fig. 5.

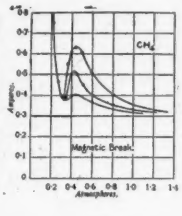


Fig. 6.

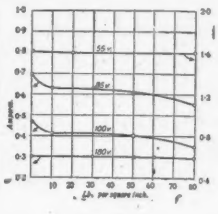


Fig. 7.

Fig. 5.—Continuous Current, 100 volts, Crossed Platinum Rods.

Fig. 6.—Continuous Current, 240 volts, Platinum Points.

Fig. 7.—Continuous Current, Electro-magnetic Break.

The curve of fig. 5 dips sharply and rises to the lower limit at a third of an atmosphere. The simplest explanation of this is that it is a continuation of the selective action which gives rise to the steps at higher pressures. Every gas examined exhibits this effect; in hydrogen it is so great that at the dip the igniting current falls almost to zero, the mixtures being those for perfect combustion. If, however, the break of circuit is made *slowly* the dip is entirely wiped out and the curve is hyperbolic.

When the break was relatively slow the lowest of the three curves of fig. 6 was obtained; increasing the speed of break caused the least igniting current to take the form of the upper curves, each of these having the same rate of break throughout.

There is, therefore, a critical relation between the collision frequency and the spark duration necessary for the observance of this effect. Above atmospheric pressure there is the singular result that the least igniting current is almost independent of pressure, falling slightly at the highest pressures. This is obtained at all voltages from 50 to 180, as shown in fig. 7.

Continuous-current spark ignition is, therefore, midway between impulsive and condenser ignition; that is, it is not a simple energy effect, for this would cause a falling curve with or without steps, nor does it work by ionisation alone. It would appear to be a very fair mean between ionic and thermal ignition.

Ignition by Alternating-current Break Sparks at the lower pressures follows the type of continuous-current slow-speed ignition; that is, the thermal action of the spark predominates, and at the higher pressures it remains nearly constant in value up to pressures approaching 80 lb. per sq. in., when it suddenly becomes easier.

This kind of spark has not been used in practice, but where break spark ignition by a movable tongue is still in use it might have some advantage. It is, however, better, if possible, to use continuous-current ignition with some inductance added to the circuit.

The influence of small changes of gas pressure upon electrical ignition is important in coal mining. Apart from the effect of pressure on the presence of gas or the dryness of the mine, a change from a low barometer of 28 in. to a normal 30 in. somewhat increases inflammability by impulsive sparks, as shown in fig. 2, but has little effect on that by condenser or circuit break sparks.

The compression of an explosive mixture increases its inflammability by condenser sparks, and lowers it when the sparks are impulsive. Circuit break sparks have the same igniting power over a long range of pressure. In every case there are mixtures in which ignition is abnormal, giving rise to steps or sudden changes in the form of the curves of observations.

The Calculation of the Capacity of Radio-Telegraph Antennæ.

By Prof. G. W. O. Howe, D.Sc., M.I.E.E.

(Section G. Abstract.)

Until quite recently the calculation of the capacity of radio-telegraph antennæ, except in the simplest cases, was looked upon as an impossibility, and one of the leading text-books on the subject stated that, "In the case of multiple-wire aerials, the only way to determine the capacity is to measure it." This is no longer the case, however, and it is shown in this paper that, even for aerials of complicated design, it is a relatively simple matter to predetermine the capacity and to calculate the effects of the earth, the masts, and anything else in close proximity to the aerial. The accuracy obtainable is more than sufficient for all practical purposes.

The principle of the method employed by the author has already been described before the British Association. It is assumed that the charge is uniformly distributed over the surface of the whole antenna, and the average potential of the antenna under this fictitious condition is then calculated. Formulæ have been worked out by means of which the average potential can be easily determined even in the case of complicated antennæ. The assumption is then made that this average potential differs but little from the actual potential which the antenna would have at every point if the same total charge were no longer uniformly distributed, but allowed to have its own natural distribution.

In the original paper, read before the British Association at Sydney, formulæ and curves were given for flat multiple-wire antennæ with any number of wires from 1 to 12, for four-wire aerials with the four wires at the corners of a square, and for wires meeting at various angles; the effect of the earth on both horizontal and vertical wires was considered, and some numerical examples of the application of the method to actual antennæ were given. In September, 1915, the author published formulæ and curves by means of which aerials of the umbrella type can be readily calculated.

In his "Principles of Electric Wave Telegraphy," Prof. Fleming gives a number of measured capacities of actual aerials of various types to serve as a guide in estimating the capacity of any other aerial. Some of these measured values agree fairly well with the calculated values, but others

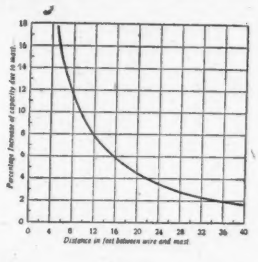


Fig. 1.

show a wide divergence; it was in seeking to explain these discrepancies that the author was led to devise a method of calculating the effect of masts and buildings.

In the paper it is shown that the use of a horizontal suspension cable for the antenna wires may increase the capacity of the aerial by 20 per cent. The presence of a mast increases the capacity of the aerial; the effect of altering the distance between the wire and the mast is shown in fig. 1.

The capacity here considered is that which would be measured by electrostatic or low-frequency methods, and is not necessarily the same as the effective capacity at radio frequencies. The latter will depend on the wave-length employed and on other factors. To electrostatic measurements a wooden mast will act as an earthed conductor, whereas at radio frequencies its high resistance will considerably modify its effect on the capacity of the aerial. If the masts be of iron or steel and not insulated, and if, as is now common, the wave-length employed is considerably greater than the fundamental wave-length of the aerial, the effective capacity will agree closely with that calculated by the method described.

The neighbourhood of a building also increases the capacity appreciably. All these cases are covered by the author's formulæ, and in addition crucial tests were made to determine the accuracy which one might expect. For this purpose wires were stretched between insulators so that the distance between the wires could be adjusted, and the separate wires could be insulated, earthed, or connected together as desired. All the dimensions were accurately measured, and the capacity was determined by a bridge method.

It was found that, under a variety of conditions, the difference between the calculated and the measured values did not

exceed 4 per cent., except in the very extreme case where the wires were only 7.45 mm. apart. Considering the difficulty of measuring such small capacities, the uncertainty introduced by connecting wires, and the difficulty of accurately determining the dimensions when stranded wires 113 ft. long are suspended in the open at distances of 1 cm. or 2 cm., the agreement must be considered very good.

The results of measurement are sufficient to show that, even in extreme cases, the author's method of calculating static capacity gives results of greater accuracy than is usually obtained in technical measurements of such small capacities.

THE WOODS-GILBERT RAIL PLANER AND GRINDING MACHINE.

The recent Municipal Tramways Association Conference afforded many managers the opportunity of observing the Woods-Gilbert Rail Planer Co.'s grinding and milling machine at work on the Bexley tramways—to the chief engineer and manager of which, Mr. H. P. Stokes, we are indebted for the following particulars.

This is the latest type of machine, and is designed so as to readily eliminate corrugations from rails, regardless of vertical or lateral rail distortion and differences in elevation of the rails.

The machine is composed of what might be termed the power unit and the working unit. The former is a substantially-built truck carrying a 60-H.P. motor, coupled through friction clutches, countershafts, &c., so as to provide an extremely mobile and flexible power unit.

The motor obtains its current from the overhead line, and is capable of propelling the machine to the required situation at a speed of 20 miles per hour, in either direction.

The main power truck is mounted upon four track wheels provided with substantial bearings and springs, each pair of wheels being connected to the motor by a silent chain drive. This provides the fast travelling gear.

The motor, which is fitted with an extended shaft, is also provided with a large diameter belt pulley driving through a countershaft on to a pair of friction cones controlled by hand levers, which may be operated from either side of the machine.

The drive is transmitted from these cone wheels through worm gearing, which propels the machine slowly during the working operation, at the same time driving the working unit—*i.e.*, grinding head or milling head, as the case may be.

The friction cones are very substantial in design, and provide both forward and reverse travel, giving perfect sweetness of action without any abnormal strain on the machine. The power unit is further provided with four heavy road wheels for the purpose of side tracking the machine—namely, removing it entirely from the tramway track on to the side of the road to allow tramway traffic to proceed. The side tracking is operated by chain drive on to massive spindles which, on being rotated, bring the road wheels into contact with the road, taking the entire weight of the machine from the tramway track.

When this operation is completed the operating clutch is thrown over in the opposite direction, and the machine at once commences to side track. The whole operation is capable of being performed in one minute. The machine can be side tracked in either direction.

The working unit, which is either the grinding head or milling head, as the case may be, is connected with the power unit by means of a pair of connecting links and a massive cantilever, pivoted so as to provide the necessary lift for removing the working unit entirely clear of the rail for fast travelling.

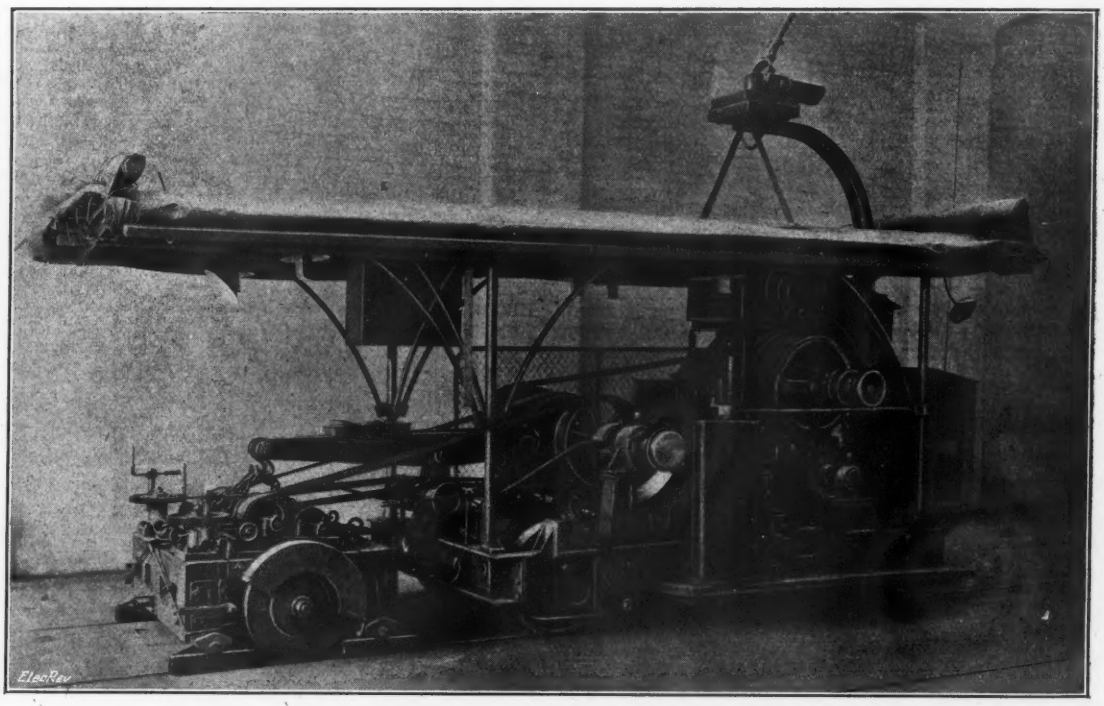
When the machine is fast travelling the interconnected links between the two units are locked together, so that neither truck moves out of relation to the other. The working unit is divided into two halves, each of which is dovetailed into the other, with a trunnion pin, so as to allow each side of the carriage to deal independently with the rail on which it is at work. By this means both vertical and lateral inequalities of the rail are automatically dealt with.

The grinding wheels also have hand-operated vertical and lateral adjustments.

Resting upon rails to be dressed, and supporting thereon each of the two sections of the divided fore carriage, are four sets of multiple rollers. Each set has seven rollers fixed in staggered position, which by this means eliminate all possibility of reproducing the corrugated surface of the rail during the grinding operation.

The two individual halves of the truck provide substantial weight, so as to give an effective cut to the abrasive wheels.

Each rail can be treated independently, or both can be dealt with together, the method of drive in each case being entirely free and independent of each other, thus allowing all possible variations and adjustments.



The Woods-Gilbert Rail Planer and Grinding Machine, showing the Grinding Head attached.

The milling head, which is attached for the purpose of deepening the grooves, cutting down projecting guard lips or other re-modelling work on the rails, is operated in a similar manner to the grinding head.

An indicator is provided in order that the depth of the cut and the dressing tool may be accurately regulated. This indicator is also provided in order that variations in the width of the track may be observed, and lateral adjustments in the dressing tools effected accordingly. It is sometimes found desirable, when milling rails, due to the rail being loose and showing a tendency to vibrate, to increase the weight upon the rail in order to effectively carry out the work.

This is readily provided for by operating the cantilever, which, when depressed at its outer end, will, by reason of links between it and the carriage sections, cause additional pressure to be exerted upon the working carriage in addition to its own weight.

In the case of the grinding carriage, suspension chains are provided instead of links, as it is not necessary to exert the pressure above referred to when grinding.

It will be seen that the main features of this machine are:—The provision of a separate working carriage built in two sections providing for universal adjustments. Each half of the said carriage being driven independently, the utmost efficiency is obtained from each.

The method of connecting the working unit to the power unit provides ready means of lifting and locking into fixed position both carriages, so as to enable the machine to proceed rapidly to other points where work is required to be performed.

The ingenious method provided for side-tracking the machine enables it to work efficiently with the least possible loss of time under all conditions of traffic.

The machine has now been in operation on the Bexley Council Tramways for approximately one month. There is still a considerable amount of work to be accomplished, after which a large contract is to be carried out at Bolton.

Two other machines belonging to the same company are also at work in the country, one at Cardiff and the other at Wigan.

The company is an Australian concern, and has already carried out very extensive contracts in Melbourne, Sydney, Brisbane and Adelaide, whilst work has already been completed on the Oldham, Ashton and Hyde, Isle of Thanet, Cardiff, Wigan, and Bexley Tramways, other large contracts already being in hand.

The capacity of the machine when surface grinding is approximately 12,000 lineal ft. of single track per month. For milling work, approximately 9,000 lineal ft. of single track per month.

The work is usually carried out at night, so as not to interrupt traffic.

The machine travels at up to 20 miles per hour when not engaged in remodelling work, and only requires three operators; it will operate on a 4 ft. 8½ in. gauge, but can also be readily adapted for other gauges.

Mr. J. W. Eunson, the chief engineer of the company, is at present in this country supervising the putting to work of new machines.

GERMAN RULES FOR POCKET-LAMP BATTERIES.

The standard rules recently prescribed for 3-cell "flash-lamp" batteries by the Verband Deutscher Elektrotechniker, in conjunction with the Union of Pocket-lamp Battery Manufacturers, should be of interest to those British firms who have taken up, or contemplate taking up, this important branch of industry. The rules prescribe that the standard 3-cell battery made up in rounded rectangular form shall have the following overall dimensions *excluding* contact springs:—Length 62 mm. (2.44 in.), breadth 21 mm. (0.827 in.), height 65 mm. (2.56 in.). The variations permitted are ½ mm. (0.02 in.) in length and breadth and 1 mm. (0.039 in.) in height. Contact strips are to be of rust-proof, springy metal and 7 to 8 mm. (0.275 to 0.315 in.) in width; the shorter strip is to be 18 to 20 mm. (0.709 to 0.787 in.) long, and the longer strip 40 to 45 mm. (1.575 to 1.772 in.). The top of the battery must be covered or run-in with a suitable material, and each battery must bear a mark permitting its origin to be traced, as well as the week and year of manufacture. The latter date is to be in plain figures (not code), and both marks must be incapable of easy removal. On delivery from the works the E.M.F. of the battery should be at least 4.5 volts, and should not exceed 4.8 volts. Provided the battery be stored and handled carefully its E.M.F. should not fall below 4.2 volts during the first 14 days after delivery, but it cannot be held to be unsatisfactory if it falls below this value after four weeks, the E.M.F. being measured by a D.C. precision instrument having a resistance of at least 100 ohms per volt of range. The internal resistance of a new battery must be so low that on connecting the terminals through a resistance of 15 ohms the E.M.F. falls by not more than 0.6 volt below the initial value of 4.5 volts. Every battery must be marked with the useful burning hours on continuous discharge and on intermittent discharges; these figures should refer to a temperature of about 20 deg. C. and to the battery as freshly delivered from the maker. When testing continuous discharge the battery is to be connected to a resistance of 15 ohms, and discharge is to be taken as complete when the terminal P.D. has fallen to 1.8 volts. The actual life on continuous discharge (to the nearest ¼ hour) may be increased by 40 per cent. to arrive at a value for the life on intermittent discharge.

The prescribed dimensions apply only to the normal arrangement of three cells side by side and with top contacts; they are not intended to hinder or discourage any modification in arrangement of cells or contacts which may appear desirable. On manufacturing grounds, battery cases may be dated ahead by eight days, but not by any longer period, and both trade mark and date of manufacture should be die-stamped. The best method of indicating whether a battery has been used or not is to place a guarantee-strip over the longer contact (and possibly over the other as well), so that the battery cannot be used without tearing away this strip. A notice should be printed on the strip that the battery must be tested (by voltmeter) before the strip is removed and provision must be made, by a hole or otherwise, so that testing is possible. Electromagnetic voltmeters of the watch type are quite unsuitable for testing dry cells, owing to their inaccuracy and high current consumption. A higher initial E.M.F. than 4.8 volts may easily be attained, but it is of no advantage, because it will soon decrease, and whilst it endures may burn out the lamp filament; an initial E.M.F. higher than 4.9 or even 5 volts is very undesirable. The minimum of 4.5 volts is prescribed for final works tests, and batteries which just pass this test will not yield 4.5 volts when received by the purchaser. If the latter is at a distance he should take care that batteries are received and tested within two weeks from the date of the works test, otherwise it may be impossible to get claims for defective cells admitted by the works within the four weeks specified as the longest period within which a battery may be expected to yield an E.M.F. of 4.2 volts. Batteries should be stored in a cool, dry place, and neglect to do so frees the manufacturer from responsibility for rapid deterioration.

The low pressure drop which accompanies low internal resistance of the battery results in more light being obtained from the lamp and a longer useful life from the battery. Purity and correct mixture of the battery materials are, however, more important than low internal resistance, which is no more than a contributory indication of excellence. The measurement of internal resistance by determination of voltage drop gives sufficiently accurate results, does not injure the battery, and is a test which can easily and quickly be made in practice. The telephone bridge method is doubtless more accurate, but is too tedious where many thousands of cells have to be tested. Formerly reliance was placed on the current developed by a battery on short circuit as an indication of the excellence of the cells; this test should be abolished, because the result is of no value unless a very accurate instrument is used, and even then the very defects of a badly constructed battery may enable it to develop a very high current on short circuit. Also, a short-circuit test, unless completed very quickly, does permanent damage to a battery. As regards the life test, discharge through a constant resistance of 15 ohms is approximately equivalent to running on a 3.5-volt, 0.2-amp. metal lamp, and gives more definite results than would be obtained by actual discharge through a lamp, since the resistance of the latter is not known accurately, and varies with the state of battery discharge. An average life figure for a batch of batteries of the same type, and made from the same lot of materials, may be obtained by taking the mean result of tests on three or five batteries. About one in 1,000 batteries delivered is generally tested for burning hours. The test is made on cells perhaps three days old, and the life then indicated cannot be obtained when the batteries are three or four weeks old In marking the life on the battery case, it should be given as the hours of continuous burning for a 3.5-volt, 0.2-amp. lamp, since this basis of reference is understood more generally than the meaning of 15 ohms. In actual service pocket-lamp batteries are almost invariably used intermittently, perhaps for a total of five to ten minutes per diem with long periods for recovery. Numerous tests show that under such conditions the total useful life is at least 40 per cent. longer than on continuous discharge, say 3½ hours as compared with 2½ hours.

TRADE STATISTICS OF BRAZIL.

The following figures show the imports into Brazil of electrical and similar goods during the year 1915. The figures for 1914 have been added for purposes of comparison, and notes of increases or decreases, as the case may be, are given:—

	1914. Dollars.	1915. Dollars.	Inc. or dec. Dollars.
Electric cable.—			
From United States ...	80,000	203,000	+ 123,000
,, Great Britain ...	127,000	1,000	− 126,000
,, Germany	77,000	—	− 77,000
,, Other countries ...	51,000	5,000	− 46,000
Total	335,000	209,000	− 126,000
Insulators.—			
From United States ...	32,000	24,000	− 8,000
,, Germany	41,000	4,000	− 37,000
,, Other countries ...	17,000	5,000	− 12,000
Total	90,000	33,000	− 57,000
Electrical machinery.—			
From United States ...	686,000	461,000	− 225,000
,, Germany	272,000	22,000	− 250,000
,, Great Britain ...	421,000	137,000	− 284,000
,, France	123,000	29,000	− 94,000
,, Other countries ...	118,000	42,000	− 76,000
Total	1,620,000	691,000	− 929,000
Electric motors.—			
From United States ...	99,000	40,000	− 59,000
,, Germany	55,000	7,000	− 48,000
,, Great Britain ...	40,000	13,000	− 27,000
,, Switzerland ...	22,000	5,000	− 17,000
,, Other countries ...	7,000	14,000	+ 7,000
Total	223,000	79,000	− 144,000

	1914. Dollars.	1915. Dollars.	Inc. or dec. Dollars.
Stationary engines.—			
From United States ...	21,000	—	– 21,000
,, Great Britain ...	39,000	—	– 39,000
,, Germany	37,000	—	– 37,000
,, Other countries ...	46,000	—	– 46,000
Total	143,000	—	– 143,000
Industrial machinery.—			
From United States ...	158,000	111,000	– 47,000
,, Great Britain ...	398,000	361,000	– 37,000
,, Germany	309,000	13,000	– 296,000
,, France	206,000	19,000	– 187,000
,, Other countries ...	94,000	47,000	– 47,000
Total	1,165,000	551,000	– 614,000
Rails, fish plates, and railway accessories.—			
From United States ...	922,000	249,000	– 673,000
,, Belgium	425,000	—	– 425,000
,, France	365,000	—	– 365,000
,, Germany	215,000	13,000	– 202,000
,, Great Britain ...	166,000	52,000	– 114,000
,, Other countries ...	123,000	2,000	– 121,000
Total	2,216,000	316,000	– 1,900,000
Lighting apparatus.—			
From United States ...	29,000	32,000	+ 3,000
,, Germany	74,000	6,000	– 68,000
,, Great Britain ...	39,000	23,000	– 16,000
,, Other countries ...	17,000	11,000	– 6,000
Total	159,000	72,000	– 87,000
Other machinery (except agricultural).—			
From United States ...	909,000	551,000	– 358,000
,, Great Britain ...	1,269,000	371,000	– 898,000
,, Germany	782,000	37,000	– 745,000
,, France	488,000	123,000	– 365,000
,, Belgium	44,000	1,000	– 43,000
,, Italy	61,000	21,000	– 40,000
,, Switzerland ...	66,000	37,000	– 29,000
,, Holland	533,000	96,000	– 437,000
,, Other countries ...	107,000	92,000	– 13,000
Total	4,259,000	1,329,000	– 2,930,000
Telegraph and telephone posts, and bridge and fence material.—			
From United States ...	62,000	41,000	– 21,000
,, Belgium	92,000	—	– 92,000
,, Great Britain ...	337,000	91,000	– 246,000
,, Germany	197,000	1,000	– 196,000
,, France	39,000	—	– 39,000
,, Other countries ...	17,000	5,000	– 12,000
Total	744,000	138,000	– 606,000
Copper wire.—			
From United States ...	12,000	57,000	+ 45,000
,, Germany	18,000	—	– 18,000
,, Great Britain ...	13,000	8,000	– 5,000
,, Other countries ...	10,000	3,000	– 7,000
Total	53,000	68,000	+ 15,000
Iron and steel wire.—			
From United States ...	70,000	607,000	+ 537,000
,, Germany	390,000	17,000	– 373,000
,, Belgium	16,000	—	– 16,000
,, Great Britain ...	65,000	51,000	– 14,000
,, Other countries ...	68,000	63,000	– 5,000
Total	609,000	738,000	+ 129,000
Rubber manufactures.—			
From United States ...	25,000	71,000	+ 46,000
,, Germany	58,000	3,000	– 55,000
,, Great Britain ...	79,000	67,000	– 12,000
,, France	47,000	58,000	+ 11,000
,, Other countries ...	47,000	50,000	+ 3,000
Total	256,000	249,000	– 7,000
Hydraulic pumps and accessories.—			
From United States ...	51,000	42,000	– 9,000
,, Great Britain ...	63,000	25,000	– 38,000
,, Germany	56,000	5,000	– 51,000
,, Other countries ...	46,000	13,000	– 33,000
Total	216,000	85,000	– 131,000
Scientific instruments.—			
From United States ...	61,000	27,000	– 34,000
,, Germany	101,000	11,000	– 90,000
,, France	50,000	9,000	– 41,000
,, Great Britain ...	27,000	14,000	– 13,000
,, Other countries ...	13,000	17,000	+ 4,000
Total	252,000	78,000	– 174,000

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,564. "Electrical water heaters." J. F. Barr. September 25th.

13,585. "Means for carrying electric cables." A. Detraux. September 25th.

13,591. "High-tension discharge apparatus." E. Wilson. September 25th.

13,593. "Electric resistance furnaces." J. C. Landtmeters. September 25th.

13,617. "Electric fire and stove." H. S. Soutter. September 26th.

13,631. "Attachment of magnetos to power units of motor cycles." C. T. B. Sangster. September 26th.

13,659. "Controllers for electric motors, &c." G. Ellison. September 26th.

13,661. "Electrical apparatus for transmitting movements at a distance." Soc. Anon. des Ateliers Brillie Freres. September 26th. (France, September 28th, 1915.)

13,664. "Combined electric stoves and toasters." H. A. Rice. September 26th. (U.S.A., September 22nd, 1915.)

13,665. "Ignition mechanism for internal-combustion engines." H. R. van Deventer. September 26th. (U.S.A., October 28th, 1915.)

13,671. "Dynamo-electric machines." The British Thomson-Houston Co. and A. P. Young. September 26th.

13,707. "Electric switches." A. Crawford, W. Preston, and W. Sanders & Co. September 27th.

13,725. "Combined switch and plug boxes for electric circuits." J. Scott. September 27th.

13,727. "Electric heating and cooking apparatus." G. Pate & A. R. Wood. September 27th.

13,746. "Electric signalling systems." R. Lambourne. September 27th.

13,754. "Electric cooking, &c., apparatus." A. F. Berry. September 27th.

13,758. "Dynamo electric machinery." M. Latour. September 27th. (France, September 7th, 1915.)

13,767. "Electric switches." V. Hope. September 28th.

13,768. "Electric overhead tramway trolley-pole attachment for preventing flash at breaking points in cable." G. T. Theobald. September 28th.

13,803. "Electric motor control." The British Thomson-Houston Co. (General Electric Co., U.S.A.). September 28th.

13,805. "Automobile electrical apparatus for welding, searchlight, &c." P. F. Smith & Messrs. Tilling-Stevens, Ltd. September 28th.

13,812. "Electro-magnetic engine." E. Bachelet. September 28th.

13,814. "Magnetos for lighting automobiles and starting internal-combustion engines." J. Bethenod & E. Girardeau. September 28th. (France, December 20th, 1915.)

13,816. "Systems of distribution." British Westinghouse & Electric Manufacturing Co. September 28th. (U.S.A., October 7th, 1915.)

13,820. "Automatic shifting devices for magnetos." L. Bignon. September 28th. (France, October 2nd, 1915.)

13,825. "Portable electric lamps." O. Hoffmann & C. Wolter. September 28th. (Germany, September 25th, 1915.)

13,839. "Improving voltage regulation on alternating-current sub-stations, feeders, rotary converters, &c." A. M. Taylor. September 29th.

13,840. "Sparking plugs." A. E. Tonks, Messrs. E. Tonks & Sons, C. W. Tonks, E. Tonks, and G. A. Tonks. September 29th.

13,874. "Means for ventilating and cooling electric generators and motors." P. F. Smith & Messrs. Tilling-Stevens, Ltd. September 29th.

13,887. "Apparatus for electrical transmission of rotary motion or signals." P. Schilowsky. September 29th.

13,888. "Magneto dynamos." P. C. Rushen (Bosch Magneto Co.). September 29th.

13,899. "Sparking plugs for internal-combustion engines." H. R. Wilks and T. Crosbee & Sons. September 30th.

13,905. "Cooling and ventilating system for electric storage batteries in submarines." M. F. Hay. September 30th.

13,942. "Electric train-lighting, &c., systems, and regulation of electric circuits." H. Leitner. September 30th.

13,943. "Telephones." F. L. Cork. September 30th.

PUBLISHED SPECIFICATIONS.

1915.

8,508. Electric Heaters and Electric Heating Apparatus. E. C. A. Marks (Landers, Frary & Clark). June 8th.

12,730. Bipolar Electrode Electrolysers. G. G. Hepburn. September 6th.

12,798. Incandescent Electric Lamps. L. Simonotti & E. Simonotti. September 7th.

12,810. Controllers for Electric Motors. H. E. Dey. September 7th. (September 29th, 1914.)

12,993. Apparatus for Determining the "Critical" or "Conversion" Point of Samples of Iron or Steel by Measuring the Electrical Resistance of a Test Piece of such Metal whilst Heated to a High Temperature. H. J. C. Simson (Saldau). September 10th.

12,999. Searchlights. E. A. Sperry. September 10th. (April 16th, 1915.)

13,033. Means for Transmitting Signals Electrically. G. B. Reeve. September 11th.

13,079. Means for Regulating Arc Lamps. J. Brockie, and Johnson and Phillips, Ltd. September 13th.

13,080. Projector Arc. Lamps. J. Brockie, and Johnson and Phillips, Ltd. September 13th.

13,216. Electrical Methods of Sounding of Church and other Bells. T. L. Southgate. September 16th.

13,481. Electric Motors. F. A. Heys (Neuland Patents, Ltd.). September 22nd.

13,587. Electric Transformers. C. H. Thordarson. September 24th.

16,550. Telegraph or Telephone Line Insulator. J. B. Alexander. November 23rd.

17,474. Electro-magnetic Relays. C. B. Burdon (Siemens & Halske Akt. Ges.). December 14th.

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1,246. Electric Circuit Controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). January 26th, 1916. [101,362.]

1,821. Automatic Telephone Systems. Relay Automatic Telephone Co., Ward. F. M. Bryant, G. M. & T. M. Inman. August 11th, 1915. (Divided application on 11,600/15. Cognate application 1,868/16.) [101,047.]

3,059. Holder for Carrying Two Separate Electric or other Wires or Cables. J. E. Grocott. March 1st, 1916. [101,372.]